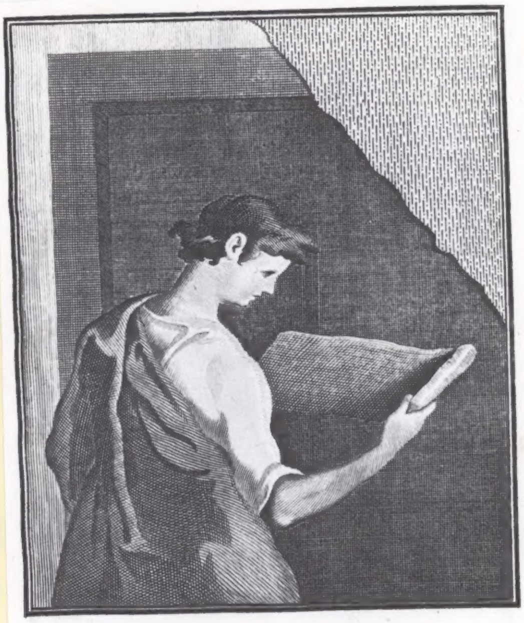

Royal Institute of British Architects.

INCORPORATED IN THE SEVENTH YEAR OF WILLIAM IV.

TRANSACTIONS: VOL. I. NEW SERIES.

FIFTY-FIRST YEAR OF FOUNDATION.

USUI CIVIUM, DECORI URBIUM.

LONDON:

PUBLISHED AT THE ROYAL INSTITUTE OF BRITISH ARCHITECTS, 9, CONDUIT STREET, HANOVER SQUARE, W.

1885.

Entered at Stationers' Hall.

DRYDEN PRESS:
J. DAVY & SONS, 137, LONG ACRE, LONDON, W.C.

TRANSACTIONS: VOL. I. NEW SERIES.

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9, *Conduit Street, Hanover Square, London, W.*
3rd September 1885.

Royal Institute of British Architects.

INCORPORATED IN THE SEVENTH YEAR OF WILLIAM IV.

SESSION 1884-85.

THE OPENING ADDRESS. By Ewan Christian, *President.*

[Read on Monday, 3rd November 1884.]

Gentlemen,

On bidding you farewell at the closing Meeting of last Session, I expressed a hope that, in the beginning of this, you would come back refreshed both in body and mind after rest from your labours. I trust that hope has been fulfilled, and though it has been said that the enforced recess is a point on which the Institute requires reform, I must say for myself that I do not in any way agree with that opinion. We all work hard, and rest is needful; and to the officers of this Institute, who to their ordinary avocations add the labour of attending to its interests, I can assure you the vacation is uncommonly welcome. As regards students, the Library is only closed for one month, and that the month above all others in which they can be most usefully learning from nature and not from books. Therefore with an easy conscience I bid you welcome to the work of the opening Session.

The year has been a notable one, both as regards this Institute, and the interests of architecture. Fifty years of existence have had to be remembered and pondered on. Valuable Papers have been read and discussed, especially one with reference to the question of education; alterations in the government of the Institute have been suggested; an important competition has been entered upon and decided; a conference has been held between the members of our own body and others outside; and lastly, we were asked to take part in an important conference at the Health Exhibition, on matters in which architects ought to be specially interested. On each of these subjects I shall have a few words to say, and I trust you will bear with me in traversing the ground.

First then, in this our Jubilee year, let us contemplate for a few moments that which, whether for good or for evil, is now irrevocably past; and then consider for a while whether in all respects we have fulfilled our duty, on the lines laid down by the Founders of this Institute.

When we look back on the fifty years of our existence, what a wonderful half century it has been! It has witnessed almost the commencement, and the great development, of

the railway system; the invention and progress of the electric telegraph; the enormous expansion of postal facilities not yet fully developed; the bridging of the ocean by swift and safe steamers of ever-increasing power and convenience; the introduction and progress of photography; the conception and execution of some of the largest and most important works of engineering the world has perhaps ever seen; the great series of International Exhibitions, commencing with that of 1851, of which the late Prince Consort was a most ardent and earnest promoter; besides almost numberless achievements in all departments of science, literally fulfilling the prophecy that "many shall run to "and fro, and knowledge shall be increased," in a manner that could only have been dimly imagined by the commentators of old. And not to travel beyond the bounds of our own art and country, it has witnessed a most remarkable revival of ecclesiastical architecture; and the rise and full development of the power, happily not yet extinguished, of the great art critic, whose fervid eloquence has done so much to open the eyes of the general public to the beauties of art in all its phases, and the glories as well as the minutiæ of nature; whose writings on the subject of our own particular art have had, and I venture to think will have, a wider influence on its study and practice than those of any other man who preceded him, for no nobler writings than those of John Ruskin have graced the half century of which I have to speak.

It has witnessed almost the whole career of one of the greatest architects of modern times—Charles Barry—and of another man of genius, architect and writer, Augustus Welby Pugin; the whole career of George Gilbert Scott, and also, unhappily as regards their termination, those of George Edmund Street and William Burges, whose loss we have so sorely mourned as all but irreparable; not to speak of those who before its commencement had made their names famous, including our first professional President, the eminently learned and graceful Charles Robert Cockerell, nor of those whose careers commencing within its area are still happily amongst us.

What the next half century may produce, if the world lasts so long, God only knows; but if I may compare the privileges now possessed by the young men of our fraternity, with those with which the great men I have named were familiar in their youth, presuming there is in the rising generation genius as yet undeveloped equal to that which has preceded it, much ought to be expected.

I cannot but remember that in the year this Institute was founded I entered the Royal Academy as a student. In those days there was indeed a Professor of Architecture who gave a biennial course of lectures to students, read by the Professor of Painting, which, commencing with primitive huts, described all the dry bones of the art, with but little allusion to its glorious beauties; there was only a small architectural library open one evening in the week, and no special architectural journal had as yet been started. When I compare this state of things with the advantages now possessed by students, in the fine library of the Institute, almost always open; in the regular instruction at the Royal Academy of a professed teacher of Architecture, supplemented by the personal supervision of eminent members of our profession; the courses of lectures

given by able professors at the University College and King's College, which all pupils may attend at small cost; besides the very valuable assistance rendered by a special architectural press, which, commencing with *The Builder,* more than forty years ago, has developed so largely, affording opportunities for the acquisition and discussion of every branch of knowledge connected with our art, almost always profusely, and sometimes beautifully, illustrated; not to speak of the host of other illustrated publications, bringing home to all of us an amount of knowledge of the scenes and buildings of far-off lands, often very valuable, and almost always replete with interest to some of us—when I contrast, I say, these differences, what large results ought to be produced, if the industry of students is at all equal to their valuable privileges!

But notwithstanding this advancement,—and in such a period of progress it would indeed have been surprising had we all stood still—let us turn to our Charter, and ponder awhile on the petition of those who asked for it.

His Majesty, King William IV, therein recites that his " right trusty and right well " beloved cousin and councillor, Thomas Philip, Earl de Grey, hath by his petition humbly " represented unto us, That he and divers others of our loving subjects have associated " together for the forming an institution for the general advancement of Civil Architecture, " and for promoting and facilitating the acquirement of the knowledge of the various " arts and sciences connected therewith; it being an art esteemed and encouraged in all " enlightened nations as tending greatly to promote the domestic convenience of citizens, " and the public improvement and embellishment of towns and cities; and have subscribed " and paid considerable sums of money for those purposes, and have formed a collection " of books and works of art, and have established a correspondence with learned and " scientific men in foreign countries, for the purpose of inquiry and information upon the " subject of the said art." And I would ask—Is it certain that we have done all that in us lay " for the general advancement of civil architecture, and for promoting and facilitating " the acquirement of the knowledge of the various arts and sciences connected therewith?"

Professor Cockerell, in his Presidential Address (23 years after the charter was granted) said:—" Hitherto we have looked to the Royal Academy, the Government " Schools of Design, and more recently the Museums of Kensington, and the two Colleges " of the London University, for those means (of education) which they command and offer " for our benefit. We hope to form schools of our own, together with those advantages, " and to offer higher collegiate grades which would reward eminence, and recommend by " certificates to the public patronage. These last, already established in the shape of " diplomas in the colleges of Law and Physic, and every learned society of the present " day, prove the advantage of their being also adopted no less in the Institute of British " Architects. Our funds, being of our own creation, are necessarily too moderate to " embark in such increased means of instruction and usefulness as we have long con- " templated, *but the time is now approaching* for the enlargement of these means to this " effect." Whether this hope of the worthy Professor is ever likely to be realized time alone can fully reveal. That we as architects, absorbed in fulfilling all the arduous duties of a most laborious profession, can ever become a teaching community, in the professorial sense,

I do not believe, and notwithstanding all that we have been told of the management of these things in France, I venture to think it is not altogether desirable that we should.

I am old-fashioned enough to put faith in the self-reliant qualities of individual Englishmen, and am afraid I must continue to think that the very eminent men, whose names I have mentioned, would hardly have attained their vigorous stature, had they been drilled and organized in the days of their youth, after the governmental fashion which has been so fully described to us by our Secretary, Mr. William H. White. But those men were giants in intellect and industry, and difficulties for them would only add to the delight of final success, and it is not for such men that such systems are needed.

That the obligatory examination for associateship with this Institute has been established, is indeed a great fact in our history, and when it is made complete, as in all fairness it necessarily must, by extension, with certain exceptions, to those who, not having passed as Associates, are seeking the rank of Fellows, one of the great results foreshadowed by Mr. Cockerell will perhaps, in this most valuable sense, have been accomplished.

But examinations necessarily pre-suppose preliminary instruction, and the question arises—Can anything be done by this Institute for its development or improvement?

Presuming that all young men proposing to enter such a profession as ours have received a complete and liberal education, I agree with the late Mr. Street in thinking that " the system of pupilage, which enables men to learn exactly how those who have " succeeded in making their mark, are in the habit of working, is no doubt the strong " point of our English system;" and if it be only of sufficient duration, and is properly followed up by taking advantage, during its continuance, of the artistic instruction offered by the Royal Academy, and that more practical teaching of the professors of architecture, and, more important perhaps still, the thorough study both at home and abroad of the works of the great masters of old—I believe that as much will be done as is really practicable towards giving a man an *entrance* to what must necessarily be a course of life-long study.

But no instruction that can be devised will make men architects, who have not the inborn genius to become so; it may, however, make them well instructed practitioners, and everything that can be done towards raising the general standard of knowledge must necessarily be in the highest degree advantageous.

Much excellent and highly commendable work has been, and is still being done by our younger sister, the Architectural Association, and if by any means the work of that valuable institution could be supplemented and aided by our elder body, in liberally sharing with them any advantages which our more matured status may enable us to supply, I think it would be desirable for both, and should by us be ungrudgingly given.

The President of that Association is now happily a member of our Council, and it is to be hoped we may always have one at least of its most influential members in that position, so that while working on different lines, the elder and the younger may move harmoniously towards the common goal of each, the end so carefully foreshadowed in the preamble of our Charter.

But while advocating, as I would very strongly, the utmost possible strengthening of this bond of mutual assistance, not less strongly would I advise the keeping of the

two bodies thoroughly distinct. Anything that would tend to depress the vigorous elasticity of the more youthful members would in my judgment be a thing to be deplored, but everything that we can do to aid them in qualifying themselves to take their places amongst us, first as Associates, and finally as Fellows, will prove, I hope, to be an unmixed benefit.

But that, irrespective of direct teaching, the past years of the Institute have not been unprofitable in result, cannot, I think, be denied by any one who takes the trouble to peruse the record of its transactions. Mr. Eastlake's Paper on this subject, read in 1876, was an exceedingly interesting and instructive resumé of what had occurred before that time, and I do not think the historian of the future will find the later proceedings, when carefully considered, at all less valuable.

As regards our ordinary meetings, we have been told that our proceedings are for the good of architects, and not of architecture, which is true in a sense, though possibly not in that it was intended to convey. Solomon says, that as "iron sharpeneth iron, so "a man sharpeneth the face of his friend;" and I heartily agree with what fell on a recent occasion from our friend William White, as regards the knowledge to be acquired in this sense from attending our meetings, for many an observation, it may be casually made in our rooms, has struck myself and been useful through life; but while admitting that, and fully acknowledging the very great value of many of the papers read, and the discussions that followed them, there can be no doubt that in ours, as in every human institution, there is room for improvement, and it behoves each one of us, if we desire the continuance of our society, to put his shoulder to the wheel.

Each member of the Royal Academy, when admitted within its ranks, has, I believe, to present within the year of his admission a work of his own, illustrative of his powers as an artist. Is it too much to ask of each of our Fellows or Associates, as they join our ranks, the contribution of an essay or paper on some subject connected with architecture or its practice, of which he has made a particular study?

I well remember that at the first meeting I attended, as a visitor, in the Institute rooms, Mr. George Godwin's valuable Essay on Concrete, which gained him a prize, was read, and I believe on that occasion, or very soon after, he was admitted an Associate. That essay stamped the character of the man, and we all know how ably and honourably it has been maintained throughout the course of a long and laborious life. Are there none of our younger brethren equally anxious to show what they can do, and would it not be good for them, and useful for us, that they should take the opportunity offered by our meetings of testing their powers?

Good papers, and free and full discussions, must continue to be the life of our meetings, and the better the papers, the more assured will be the reputation of those who read them; and the criticisms afforded by discussion will be alike useful both to writers and hearers. Nothing is more important than that our meetings should be always made interesting, and if interesting, they can scarcely fail to be instructive.

Our aim as Members of this Institute should be, in the words of our Charter, "the "general advancement of Civil Architecture, and the promoting and facilitating the

"acquirement of the knowledge of the various arts and sciences connected therewith," in every possible way, and so long as we act on these lines our work will clearly show that the protection of our own material interests is not the great end of our corporate existence.

The honourable practice of a noble profession is what our Charter requires, and should be one great object of our lives as architects, and, in my judgment, nothing is more likely to conduce to the attainment of this end than the free intercommunication of ideas, which must almost necessarily result from loyal association with one another as members of this Institute.

As regards our future—in the early days of the Institute its correspondence was almost entirely limited to the old world, and naturally so, because there alone are to be found the glorious structures of the architecture of the past; but when we consider the enormous expansion of the greater England beyond our shores, and yet within such easy reach; when we see or hear of the wonderful cities that by the energy of our fellow countrymen have been entirely built since this Institute was founded; it cannot, I think, be doubted that more active measures should be taken for enlarging the area of our sympathies and our correspondence, and to aid in the development of the work of those younger people, of whom so much may hereafter be expected. Statesmen are turning their attention to the federation of the English-speaking colonies, and if the Institute can do anything to aid the bonds of union, it will, in my judgment, be a mutual benefit.

Nothing is more remarkable than the clinging of the colonists of Canada, Australia and New Zealand to the old country, and anything that can be done to foster this attachment must, I think, be a step in the right direction. Already there are in Australia and New Zealand several members of our body, and we hope that their numbers may be increased, and that in India also we may be more strongly represented than at present. While speaking on this point I may remind you that at a Special General Meeting, held last March,[1] in response to applications from abroad, a by-law was so altered as to provide that examinations can now be conducted with a view to the admission of any architects beyond the sea, who desire to share in the privileges of membership.

But, gentlemen, there is, as you are aware, a further question as to the future which requires to be faced. Hitherto I have spoken chiefly of our past and present existence as a body corporate under a Charter, and have said but little as to internal government.

I must confess that until I needed it for the purpose of this address, I had never very carefully studied that Charter, and consequently did not know, as I ought, how much we were really indebted to the men who framed it. Only one of them now remains, the loved and honoured Nestor of our Institute, Professor Donaldson, and therefore we cannot now thank them for the pains they took in providing for its settlement.

It is a very valuable document, and, for the times in which it was granted, everything that could be desired, and, as I hope I may have shown you, it has been useful as a text for myself. But times and practices have greatly changed since it was framed, and the bonds in which in some respects it holds us, are hardly consistent with the expansion which in others has enlarged our view. Whereas in our older days London architects were almost

[1] See the Journal of PROCEEDINGS, 1883-84, page 108.

a class apart, and provincial men seldom wandered beyond their own cities or districts, it may now almost be said that there is no such thing as provincialism. Our members are to be found everywhere, from the east to the west, from the north to the south; and it should be our aim to bind them all together in one strong brotherhood of mutual regard and confidence, and to make their privileges equal to our own.

Outside our ranks also there are able and honourable men who cannot join us, owing to minor technicalities which we would willingly brush aside, were it not for the fetters which by our Charter are imposed. There is further a strong section of our body which feels, and, as I think, justly feels, now that the examination test has been finally settled, that Associates have a right to a larger share in the management of our affairs than the Charter allows.

All these facts point to the necessity of change and, provided it can be prudently accomplished, I for one shall rejoice in the improvement. Naturally, as Englishmen we all, I hope, detest revolution, but the best way of avoiding such catastrophes is by the timely institution of necessary reforms. With this view, therefore, and for the purpose of meeting all questions that have lately arisen with reference to the points I have named, or otherwise, a special Committee has been appointed, and is in communication with the Honorary Solicitor: Firstly, as to the possibility of amending the existing Charter or of supplementing it by additions; and secondly, failing the possibility of such changes, for ascertaining whether a Charter with new provisions could be obtained without sacrificing the tradition of that which we at present possess.

These are important questions which require time for safe solution, but I think you may rely on the desire of the Council to bring them as speedily as possible to a satisfactory termination. A Charter is undeniably a good thing; it gives to an Institution like ours a breadth of base and solidity of structure such as we, as architects, ought greatly to prize. Most of us, I hope, have some reverence for that which is old, when it has been proved to be valuable in the times that are past, and if, without danger to the future, we can amend and retain what we already possess, it will be the part of wise men not to let it slip.

On the subject of a recent Competition you will probably expect me to say a few words. On competition in general, so much has been said, and so often, that I need not detain you by further remarks of my own. That competitions are an inevitable characteristic of the age; that they were not altogether unknown in the earlier days of our art, and that, when conducted on the strictly honourable principles, such as should always characterize the practice of the architect, they are by no means the unmixed evil that some would represent, has long been my own opinion, and it has not been shaken by what from time to time has been said on the other side.

I cannot myself see why, if we offer prizes to young men for the best designs or drawings produced by them as students, and which most of us think is an incentive to industry in acquiring a knowledge of their art, they should in after years be debarred from securing by similar means that employment in professional life for which their

former efforts have been the best preparation. But be that as it may, competitions cannot be got rid of, and all we can do in this Institute is to use our best endeavours to get them conducted on sound and fair principles. I think we are all agreed that no competition should be decided without the aid of a professional referee. This necessity is now much more frequently recognized than was formerly the case, and applications are not unfrequently made to the President, or the Council, for advice as to the appointment of architects as adjudicators; but it must rest with competitors themselves to insist on the adoption of this safeguard to their interests. Human nature being constituted as it is, it is not to be expected that any decision, however just, will satisfy all competitors; but if, instead of railing against the inevitable, men would take pains to search out the reason of their failure, we should perhaps hear less than we sometimes do as to corruption and unfairness, where none may at any time have really existed.

As regards the Admiralty and War Offices Competition, for the decision of which I had the honour to be selected as one of the professional judges, it would not become me to defend the action of the judges, or to criticise the views of those in authority who prepared the instructions upon which this judgment was to be founded; I will only say this, which I believe may be taken as entirely true, that the sole object of the latter was to get the best possible building for the detailed requirements of the public service, and of the former to discover, without fear or favour, the men best qualified to carry their instructions into effect. Whether that end has been accomplished it must be left to the future to declare; I can only say that no pains were spared by any of us for arriving at a just conclusion, and whether our judgment was right or wrong, it was that which each one of us honestly believed to be right, and, right or wrong, it was absolutely and entirely fair. It has been said that none of the designs selected were of a monumental character; but when a problem is put before architects, not chiefly for the production of a grand national edifice, but for the convenient accommodation, in their every-day work, of some 1500 clerks of varying grades, all requiring the primary requisites of light and air, easy access and communications, and of comparatively few of the higher officials and chiefs of departments, with practically no rooms needed for State receptions, and all to be got within a very limited area—it would be a difficult task indeed to combine so much of commonplace, with an exterior of monumental character!

Truly to my mind the conditions of the problem were barely reconcileable with architectural magnificence, such as might possibly please outsiders, but would be in many respects opposed to the every-day wants of the working bees to be accommodated within.

Much has been said, and much more will doubtless be said, in criticism of the selected design. I shall not add to those criticisms; but to my mind it is little short of wonderful, that, whatever its faults of detail may be, so fine a plan, and so good an elevation, should have been entirely wrought out by men, solitary students in a provincial town, with no special advantages, untravelled, unknown to the world of art, and who have produced drawings of the most remarkable delicacy, which may have been equalled but never, in this country, to my knowledge, surpassed for perfect execution; that such drawings as those submitted in each competition should have been prepared in so short a time, as I

understand, by two men (one of them at the time an invalid) and a youth, working together, without extraneous assistance, excepting as regards perspective and figure drawing—whatever else may be said—is undoubtedly a very remarkable example of that "well-"directed labour" to which, as the great first President of the Royal Academy said, "nothing is denied."

I will not refer to any other case of competitions, but it may not be inappropriate at this time to say a few words on the treatment proposed for one of the noblest of our ancient monuments; and just as the First Commissioner of Works deserves our thanks for his determination to see absolute fair play in the decision as to the new buildings, so I think is he to be congratulated on what he has done with reference to the opening-up and preservation of Westminster Hall. The clearing away of the old Law Courts has revealed to us a picture such as we could hardly have anticipated, a vision of magnificent simplicity and proportion which, having once seen, we can hardly bear to lose again. The appointment of Mr. Pearson, as architect for the restoration of the old building, showed a wise discrimination and determination to do the best thing possible, and the very able and exhaustive report presented by him is a further confirmation of the wisdom of the choice. But while there can be no doubt whatever as to the necessity of the structural restoration of the great Hall itself, it is permissible to regret that it should ever again be concealed from view by any new buildings, however correctly designed on the ancient lines, that may not be absolutely necessary for permanent sustentation. I think in this case the action of Parliament is hardly to be regretted, if it gives further time for the consideration of a subject of unquestionable difficulty—one which deeply concerns all who care, as we should do, for the preservation of our ancient monuments.

With regard to the Conference held in the month of May, it will, I think, be unnecessary to detain you with many observations. Admirable memoirs were, as you will remember, read by Mr. Wethered on Viollet-le-Duc; Mr. Beresford Hope on Street; and Mr. Aitchison on Burges; each replete with interest for us as architects. Valuable papers also on Architectural Practice were contributed and discussed by members of our own body and visitors from various parts; the reports of which have been duly recorded, and will, I hope, be found profitable reading in the future. Professor Kerr wound-up the Conference with a paper, which Mr. Beresford Hope rightly termed "a "very brilliant one," on English Architecture thirty years hence; but although it was an essay of very great interest, I am not sure that the learned professor has drawn aside the veil which covers the future, so completely as he would desire; and he would indeed be a bold man who would venture to prophesy what is immediately in store for us. I cannot but agree with him, however, in hoping and thinking, if I may quote his own words, that "it may not improbably be the destiny of England at a period by no means "remote, in the development of the advancing scheme of Anglo-Saxon civilisation, to "assume a leadership,—such as she already possesses in so much besides,—in the "illustrious art which it is the pride and the joy of this assembly to represent." I trust the gentlemen who visited us from the Provinces were not otherwise than gratified with

the reception accorded them, and have taken back to their homes a pleasant and profitable recollection of this happy reunion.

The Conference at the Health Exhibition stands on a different footing to that to which I have just briefly alluded, but as many of us took part in it, and a full report of its proceedings will shortly be published, I do not think I need refer to them in detail; most of the subjects treated on were familiar to us as architects, and it was rather for the benefit of the outside public than for our own instruction, that the papers were prepared. Let us hope that some few individuals, out of the millions who visited the Exhibition, may have taken to heart a few grains of knowledge and common sense, which may hereafter expand and bear fruit, and be useful to many besides those who were the immediate listeners. Perhaps, however, exception should be made in calling attention to the papers read by Mr. Aitchison and Mr. William White respectively; the former on " the sanitary aspect of internal fittings and decoration," and the latter on " the "hygienic value of colour;" both ably treated, and valuable alike to the architect and to the general public, if they care to profit by them.

The remarkable success of this Exhibition has indeed been one of the great features of the year now drawing to a close, and I think it may be gratifying to us, as architects, to know that the interesting work of one of our own members, Mr. Birch, in reproducing the picturesque features of the streets of old London, which he has done so learnedly and well, has not been the least attractive feature of the show.

Before concluding my remarks, it is right that I should say a few words on the losses we have sustained in the thinning of our ranks by death, and on the position in which we now stand as regards numbers and financial prosperity.

In respect to the first, we, in common with the whole English people, have had to mourn the untimely removal of a Prince pre-eminent alike in natural gifts and cultivated intelligence; one whom we had fondly hoped would not only have been an honour to our country, but of great service in all questions relating to our art—a hope, alas! not to be realized. The Council thought it their duty to present an Address of Condolence to our Patron, H.M. The Queen, which in due course was graciously acknowledged.

We have also had to regret the loss, though in the full ripeness of years, of a most valuable member of our body — Mr. Knowles; a man who, having passed a most laborious life in the active performance of professional duties, might well have claimed in his declining years entire rest, but who preferred to remain amongst us as an Examiner and Member of Council, where I may safely say his presence was always as welcome as his opinions were valuable. His last appearance at the Council table only preceded his death by a few days. In Edwin Nash we lost a most excellent man and an architect of no mean power; one always ready to help as a member of the Institute, and a genial and honourable practitioner in our craft. He left an example in his will which may be usefully followed, in devising a legacy of £100. to the insufficient funds of the Architects' Benevolent Society. Charles Henman, less known to most of us, was one of my earliest professional friends; an able man, who, if he had not been possessed of

independent means, would probably have made his mark more strongly than he did. He has left two sons still happily numbered in our ranks. Many of you will have known, though I did not, William Pettit Griffith, one of our Fellows, who, I believe, was very highly respected. In Sir William Siemens not only we, but the whole civilized world, sustained the heavy loss of a prince amongst inventors, and a most genial man, always ready to impart to others, as he did to us at the Institute, some portion of that store of knowledge of which he was so largely possessed. Nor must the name of that enthusiastic antiquary, John Henry Parker, the publisher of the *Glossary of Architecture* and the ardent explorer of the antiquities of Rome, remain unmentioned.

Amongst eminent foreigners our losses have been still more considerable — two Gold Medallists, Professor Lepsius of Berlin, and Jean-Baptiste Lesueur of Paris, besides two other Hon. Corresponding Members, Paul Abadie and Antoine Chenavard. Lastly, we have lost our Hon. Associate, the eminent physician, Sir Erasmus Wilson, to whose munificence, I believe, we owe the bringing to our shores of the obelisk now standing on the Embankment.

But notwithstanding these losses[2] our numbers have increased, and we may be said in that respect, I believe, to be in thriving condition. I believe also it may be very safely said that our financial condition is thoroughly sound.

Finally, gentlemen, although there are several other subjects on which I could have desired to speak, I think I have detained you quite long enough. The past and the future of our own body is to us a theme of no little importance, and in this fiftieth year of our existence I have thought it better to confine myself mainly to its consideration, rather than to wander on the wider field of survey, which might possibly in some respects have been more congenial both to you and to myself. We have seen, I think, that the aim of the Founders of this Institute was high and noble; let our standard in the future be raised still higher. Their work was begun in weakness, let ours be continued in strength; and putting aside all petty jealousies, let us combine, not for mere personal advantage, but in the truest and most liberal sense for the advancement of our art, and the establishment of its practice on that broad basis of honourable principle, which alone is worthy of the noble profession to which we belong.

EWAN CHRISTIAN.

*** The vote of thanks to the President for his Address was moved by A. B. Mitford, C.B., *Hon. Associate,* Secretary of H.M. Office of Works and Public Buildings,

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[2] In addition to the twelve deceased Members mentioned in the Address the Institute has lost during the preceding twelve months four Associates, namely:—Henry Blackwell, elected in 1879, Charles Marriner, elected in 1881, William Paice, elected in 1878, and Alfred Granby Winsor, elected in 1882, all of London.

and seconded by Charles Barry, F.S.A., *Past President.* In the course of the proceedings, the Rt. Hon. G. J. Shaw-Lefevre, M.P., First Commissioner of H.M. Works and Public Buildings, who was present as a visitor, congratulated the President upon his Address, and offered some observations upon various topics referred to therein. A report of the speeches made on this occasion appeared in the Journal of PROCEEDINGS, 1884-85, pages 14-19.

II.

THE INTERNAL TREATMENT OF CUPOLAS IN GENERAL AND THAT OF ST. PAUL'S CATHEDRAL IN PARTICULAR.

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[Read on Monday, 17th November 1884, Ewan Christian, *President*, in the Chair.]

I PROPOSE to confine my remarks to classic cupolas—not that I undervalue the beautiful vaultings left by our mediæval forefathers—or the wonderful examples in India—but the time is not long enough.

CUPOLAS AS TO PLAN.

Perhaps the most comprehensive manner of considering the cupola will be as the application of a cove to a mathematical figure on plan. In an ordinary semicircular barrel-vault, each half counterpoises the other half: we take a half of it and we have a cove, we may then apply that cove to a regular polygon of any number of sides, making the radius of the cove equal to the semi-diameter of the polygon; and we shall have a square cupola, a hexagonal cupola, an octagonal cupola, &c.;[3] and considering the circle as a polygon of an infinite number of sides, we may apply the cove to a circle and obtain the hemi-spherical cupola, in which all angles disappear and we have a smooth unbroken surface.

Square unpenetrated cupolas are not common, I only know those of the second stage of the Loggia in the Vatican, decorated by Raffaello, and the beautiful little chamber in the Convento di S. Paolo, at Parma, decorated by Correggio. The latter is decorated with a Pergola.

Octagonal cupolas are numerous enough: the most celebrated being that of the Duomo at Florence.

Dodekagonal cupolas are less common: I only remember to have noted that of Siena.

Polygonal cupolas, however, must be omitted for the present, as the time will not allow of any attempt at adequate treatment.

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[3] We should probably term the square cupola "a coved ceiling," but for classification it must be considered as a cupola.—H.S.

Circular cupolas are legion, some of the most celebrated being the Pantheon at Rome, St. Peter's at Rome, and our own St. Paul's.

Elliptic cupolas are sometimes used; those I have noted being: the Duomo at Pisa, St. Andrea fuori del Popolo at Rome, S.M. di Monte Santo at the top of the Corso at Rome, Sta. Croce at Padua, and SS. Trinita in the Via Condotti at Rome. With the Coliseum before their eyes the attempt was natural; and fairly successful. The entrance in every case is on the longer axis of the ellipse; and by the foreshortening, resulting from well-known laws of perspective, the effect is often very good; we do not at first realize the departure from usual custom: of course if the entrance had been on the shorter axis the result would be different. At Pisa the ellipse is over the crossing, with its longer axis coincident with the axis of the building; in the other churches the ellipse, with its belt of chapels, is the building, *i.e.* there is no crux.

The above-mentioned cupolas are simple and complete: there is, however, a series of cupolas to which I apply the term "*Abscissate,*" which must be considered. Their development was very clearly explained by the late Sir G. G. Scott, in his lecture at the Royal Academy, in March 1873.[4] The term is derived from the Latin, Abs-cido (from abs and cædo) "*I cut-off,*" or "*I cut-away.*" The plane which cuts-off being always supposed to be vertical, as if a portion of the wall were produced to cut the spherical surface, and support the spherical vault. Good examples of abscissate cupolas are to be found of the Byzantine period, *e.g.* at Hagia Sophia at Constantinople, at S. Marco at Venice, and more modern in the vaults of the first stage of the Loggia of the Vatican, the staircase in the Braschi Palace at Rome [Illustn.] i. 6, &c.

Pierced Cupolas.—Another series of cupolas is the *Penetrated.* In these the bounding lines do not lie in vertical planes, but, owing to the stilting of the penetrating vaults, they oversail. When a cupola of circular plan is penetrated by windows or vaults round the base: if the openings are semi-circular the result is an abscissate cupola; but if the openings have straight sides and flat top (*a*) or with circular arch (*b*), the straight sides cause the opening to oversail. This oversailing requires a special treatment if the sides are plumb, and the penetration is by two planes which are parallel to the axis of the window

[4] It is a property of the sphere that every possible plane section of it is a circle. It follows that every vertical section of a hemispherical or segmental dome assumes the form of a semicircular or segmental arch. If, therefore, a square be inscribed in the base of a dome, and walls be built on that square, and continued up till they meet the dome, they will intersect with it in four semicircles. If, instead of walls you build arches on the sides of that square, these arches will coincide with the curve of the dome where they meet it; and, if strong enough, will carry the portion of the dome remaining between them. If again, instead of arches, you supposed the dome intersected on the lines of the inscribed square by vaults at right angles to those sides, the result will be the same. In the first case we have a dome, or a portion of one, covering a square apartment; in the second we have the same covering standing on arches open towards the exterior; in the third we have a dome covering the intersection of two barrel-vaults, just as is more usually done by groining. The process, however, is not limited to a square; it is equally applicable to the octagon or any other polygon—indeed, to any figure which can be inscribed in a circle. Nor is it necessary that the inscribed figure should be complete, for remnants of the circle may equally well be left between the arches or walls. Thus, a circular space may be intersected by four vaults of less width than the sides of a square, [as in St. Peter's at Rome] leaving portions of the circular walls remaining between them.—*Sir G. G. Scott's Lectures.*—H.S.

or vault, because while each section of the cupola is decreasing as it ascends, these, remaining the same width, *appear* to *increase*, which has a very bad effect. In the church of the Gesú in Rome, there is an instance of the ignoring of this difficulty. The planes forming the reveals of the windows are parallel; but the portions of the cupola between them are radial, *i.e.* in sections; and hence they cut-off a portion of the light. In another church in Rome the reveals are parallel and the portions of cupola surface between them are panelled; and the style is continued to form a stellar panel in the centre. This is somewhat Arabic in treatment, about which I shall speak later; but if the window-heads had been segmental, the shape of the centre panel would have been pleasanter and less marked. It is however, as it is, an interesting example of the manner in which the true artist seizes the very difficulties of his work and bends them into new beauties.[5]

The penetrations should be at axial points; and hence when figure decoration is applied it should be unaxial; this is so at S. Marco, where however there are two tiers of figures disposed alternately, or "breaking joint," and the upper and more important figures *are* axial. Also in the Capella Palatina at Palermo, there are figures of archangels between the penetrations of the [axial] windows; but these are so severely treated that they take their place as pier decorations; and their want of axiality is not so strongly felt as it would be if they had been treated with greater fulness of chiaroscuro or freedom of composition.

Some of the cupolas pierced with circular openings are beautifully treated. The "bull's eye," or "œil-de-bœuf," seems to lend itself to easy and simple treatment; and the circular panels borrowed from this are equally good, as will be seen later on.

When the cupola has a central opening or "eye" at the crown, I term it an "oculate" cupola; most cupolas with lanterns are oculate. Sometimes the opening is for light, as at the Pantheon at Rome, at St. Paul's, &c.; sometimes for the purpose of seeing a picture painted upon an outer cupola, as at Ste. Geneviève at Paris, &c.

Typical Treatments.

When cupolas are abscissate or penetrated the contour of the perforation rules the architectural treatment; but when the cupola is simple and complete, the subjacent architecture, and the "eye," if there be one, guide us; there are, thus, three things to consider in devising the treatment:—

(*a.*) What is the plan of the cupola? (*b.*) Is it abscissate or penetrated? (*c.*) Is it oculate? and (*d.*) When the cupola is simple and complete, what is the subjacent architecture?

The typical treatments are nine in number:—

(1) Those resulting from vertical sections of the cupola, *e.g.* ribs.

(2) Those resulting from horizontal sections of the cupola, *e.g.* marginal panels and zones.

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[5] Penetrated cupolas and penetrated vaults show a soffit (*a.*) which will be as deep as the amount of the oversailing. This soffit is always seen in perspective along with the face of the vault and should be considered in reference to it; but the number of good vaults which have been spoiled by their penetration soffits, owing generally to the careless treatment of them as afterthoughts, is very great.—H.S.

(3) Those resulting from a combination of the above two systems, *e.g.* coffering.
(4) Those resulting from panelling.
(5) Those borrowed from arches.
(6) Scenic architecture.
(7) Those resulting from the attempt to ignore the architectural necessities of the case and treat the whole cupola as if it were a flat unpierced picture.
(8) That based upon the "characteristic section" of the hemisphere, *i.e.* circles.
(9) Those which treat the cupola as a simple concave and leave it plain, or powder it with stars or other ornaments.

(1) Rib Treatments: *Ribs* are very much used in cupola treatments. They are most appropriate in *large* cupolas surmounted by lanterns, *i.e.*—(*a.*) *large,* which demand sub-division, and (*b.*) *surmounted by lanterns,* as they converge towards the eye of the cupola and form a suggestive support for it, and so satisfy the eye.

On the other hand it is said that "vertical ribs and panels would be perfectly right "for an octagonal dome such as that of Florence, but to cut up a fine hemispherical dome "in that fashion, however sanctioned by precedent, is to destroy the very beauty which "specially characterizes the dome, the idea of mystery and infinity, and to parcel it out "into measurable littlenesses." In reference to this I answer, firstly, that both the experiments by my colleague and myself are *sections,* and are, therefore necessarily, more fragmentary in effect, with the rib more strongly marked than if a wider portion of each had been shown; and secondly, that the statement is not correct. In an octagonal cupola there are corners in the surface where the curved sections meet each other and mitre; and it is obvious that one method of emphasizing the construction is to have narrow ribs at the corners, as was done by our mediæval forefathers; but the ribs must be *narrow,* like theirs; though it is also equally clear that *wide* or panelled ribs would be absurd and unsuitable to octagonal cupolas because of the bad effect of the want of solidity, given by the hollow angle, at the corners; and I do not know a single Renaissance octagonal cupola which is treated with narrow ribs. We may therefore affirm that broad ribs are not suited to cupolas of octagonal plan. The rib, both narrow and broad, has been continually used with the happiest effect in cupolas of circular plan, with no sense of making them *polygonal;* for where, as at St. Peter's, they are narrow and numerous they give the impression of a polygon with an infinite number of sides, which is a *circle;* and where, as in St. Paul's, they are fewer and broad, their very breadth shows that no corners exist; if there be no corner, then *no octagon;* and therefore the broad rib is not only not unsuitable to the circular plan, but it is in fact suitable and *suggestive* of it.

The number of ribs may vary from four indefinitely. Four ribs have been sometimes used in an abscissate cupola, springing from the angles; but it is not a good treatment, as it tends to give the effect of a groined vault, and thus destroys the effect of homogeneity which is one of the beauties of the cupola.

Eight ribs are much better. They are arranged *unequally, i.e.* in four groups or pairs, as in the church of the Abbaye Royale de St. Louis at Metz [Illustn. i, 1]. They are

arranged equally in the Certosa of Pavia, the Baptistery of S.M. presso S. Satiro at Milan, and in the Sistine chapel in S.M. Maggiore at Rome. In the last example, fig. 2, the pilasters of the subjacent architecture are "cotised," *i.e.* each has half a pilaster joined to it on each side; and the ribs are similarly cotised, producing a well articulated effect.

Sixteen ribs have been used; of those which are spaced unequally in eight pairs, the church of the Sorbonne in Paris is an example. It is well articulated somewhat like "a smaller edition" of St. Peter's at Rome. Of equal spacing the Baptistery (Gothic) at Parma [Illustn. ii, 5], and St. Peter's at Rome are examples.

Twenty-four ribs are also used: unequally spaced in twelve pairs as shown in the first treatment of the Church of the Invalides at Paris [Illustn. i, 3].[6] An equally-spaced example is the Church of Hagia Sophia at Constantinople.

Many-ribbed examples may be seen at the reading room at the British Museum, and the Royal Albert Hall at Kensington Gore.

In most of the above examples the ribs are of the same width as the subjacent columns or pilasters; and the effect of the articulation is entirely satisfactory, the exceptions only serving "to prove the rule."

The spaces between the ribs are often *sub-panelled* with circles, as may be noticed in St. Peter's; and in the church at Milano; and with small coffering as at S.M. della Salute at Venice [Illustn. i, 4], and at S.M. della Pace at Rome.

Radial figures are nearly allied to radial ribs: they may be termed the translation of a frieze, or the application of a frieze round a cupola. There are examples in the two Baptisteries at Ravenna, in the apses of the early Roman basilicas, and in the early cupola work at S. Marco.

Intersecting ribs (Arabic) are also applied to cupolas of all shapes; but they are most suitable to abscissate cupolas, because in them the radiation of the ribs from the points of support appears more constructive; it is then analogous to the fan-vaulting of later Gothic. We may in a circular cupola assume eight points, and make arched ribs on the surface of the cupola from each point in turn to each of its neighbours and to each alternate point, as in the Gothic vault over the kitchen of Durham Monastery;[7] or we may turn arches from the points in a square cupola, resulting in a similar design to that of the Mosque of Cordova.

Parallel ribs may be used with good effect in abscissate cupolas. They will lie in vertical planes parallel to the abscissate planes. An example exists in the chapel of the Belcaro Palace near Siena. Another case is that in which the ribs are parallel to the mitre-line of a square cupola. An example occurs in the second stage of the Loggia of the Vatican.

(2) Marginal panels: These have been sometimes applied round the base of a cupola, as in the church of I Gesuiti at Venice, and St. Andrea della Valle at Rome.

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[6] This cupola was afterwards altered to the design shown in the right-hand half of the figure: the ribs shrunk into narrow stiles with panel between, over nothing in particular; the effect bad.—H.S.

[7] Gwilt: 1859 edition: p. 837, fig. 33.—H.S.

Zone treatments are occasionally to be met with, the best known being those of the Baptistery and the Cathedral at Florence, and the Church of S. Giorgio at Venice. They have been used over *apses,* where they are not objectionable; the well-known Assumption by Botticelli, in the National Gallery, being a representation in point. The effect of zones in cupolas is to reduce the apparent height; and by dragging down the summit, to destroy all the fine effect obtained in the vast concave at much cost.

(3) Coffering: This has been always a favourite method of treating cupolas. Some interesting examples exist, the small Pellegrini Chapel in the Church of S. Bernardino at Verona [Illustn. iii, 10] being a beautiful example: there is one coffer over each window and two are over the angle abutments; and the stile is the same width as the columns and pilasters, so the whole is well linked together. In the small Church of S.M. Maddalena at Venice [fig. 9], the twelve columns are arranged in six couples with the stiles resting axially upon them; and the whole is pleasing. The unsatisfactory effect of the want of accord between the pilasters below and the stiles above, may be seen in the Corsini Chapel in S. Giovanni in Laterano at Rome [Illustn. iii, 11]; and a good treatment for the same arrangement of subjacent coupled pilasters is to be seen in the Church of S.M. di Carignano at Genoa [fig. 12], in which the stiles are the same width as the pilasters, and the coffers vary in width to suit the two distances in the intercolumniation. S.M. della Salute at Venice [fig. 4], shows an axial rib with coffers between. Hexagonal coffers have been used: the Church of S.M. della Pace at Rome, in which they are used between narrow ribs, being an example; octagons are used in Ste. Geneviève at Paris, and elsewhere; circular coffers (in glazed earthenware) are used in the Pazzi Chapel in Sta. Croce at Florence. Diapers of octagons, &c., may be seen in the monograph of the Radcliffe Library at Oxford, by Gibbs. Octagonal coffering, with long and short panels, for articulation, was used in the rotunda of the Villa Almerico near Vicenza [Illustn. ii, 8].

(4) Axial panels and subjects without ribs: Often used. By panels I mean shapes which are irregular and not necessarily arising from beam or rib construction. Coffering or lacunation supposes *beams* on which to lay the lacunæ: panelling (cloth) is division by *frames.* Interesting examples may be seen in the ceiling of the Camera della Segnatura in the Vatican Palace at Rome, and in those of the Villa Madama near the same city. I do not deal with the many grotesque treatments, as these belong rather to fanciful decoration than to architectural treatment.

(5) Arches: Rarely used. The outside of the Pantheon vault in M. Viollet-le-Duc's *Dictionnaire,* vol. IX., page 477, is well known: a somewhat similar treatment exists in the Royal Mausoleum at Turin. Sometimes the arches are in tiers, as in Mr. Penrose's second design for the decoration of St. Paul's or in the (slightly different) design by the late William Burges. Sometimes the arches are combined with ribs, as in St. Peter's and the Sorbonne. Sometimes they are used in connection with scenic architecture, all in perspective and painted in chiaroscuro, as in the work by Thornhill now in St. Paul's [Illustns. vi, vii].

(6) Painted or Scenic Architecture: This had its greatest development at the

time when the art of perspective was reduced to scientific rules by the labours of such men as Guidi Ubaldi, A. D. 1600. Perspective had been much used by Benozzo Gozzoli, in his Tower of Babel tempera in the Pisan Campo Santo about the year 1475; but here the perspective is only shown in the architectural buildings introduced into the pictures. Later on was invented and practised the art of representing "*di sotto in su*," and painters would often take a perfectly flat ceiling and by means of their art (or their artfulness) add additional storeys to the walls upon it, with such accuracy of drawing, and such admirable ærial perspective in the gradual softenings of their tints, that they destroyed the surface and converted the church into an atrium, round which appear walls, columns, and pilasters, arches and towers piled upon each other with a lavish profusion, which would have gladdened the soul of Piranesi, but which would have been contrary to the Metropolitan Building Act. These perspective additions to the true architecture of the place are correct enough when seen standing upon the particular slab in the pavement to which the custode leads the visitor; but from every other point in the church they have a most dreadful effect by the appearance of falling-in they present. One of the most celebrated of these scenic roofs is that by Fumiano, in the church of S. Pantaleone at Venice, A. D. 1690. This is on a carved surface, and so the great skill necessary in the perspective may be readily imagined. He painted it on linen in his studio; and when it was fixed up, and he saw the effect, he committed suicide. All this is really so much scene-painting totally unworthy of being employed in any monumental building. We admire the ingenuity and ability of the various men[8] who have designed and carried out these works, and feel they were masters in the art of perspective, like Stodge in Charles Keene's sketch, but we regret that they did not employ their talents in a more truthful manner.

The Pergola is often used in small apartments. The rich colour of the vine-leaves and grapes, with the play of sunlight upon them, and on the beautiful blue grounds, is perfect. It can be applied to any shape of surface; and is very suitable for a small apartment where its small scale is appropriate; and to a casino or villa where license in decoration may be tolerable; but it practically annihilates the roof; and it cannot be permitted in any monumental building.

(7) The method of treatment, associated with the name of its greatest exponent Allegri of Correggio, is scarcely to be mentioned as an architectural treatment; but any list would be incomplete without the record. It may be made, like the Pergola, to suit any form, as there is no axial arrangement necessary; and if there were any attempt at axial groups they would have a very artificial appearance. The fine work at Parma has always been admired by painters for those technical qualities, of clever foreshortening, colour, and chiaroscuro, which are peculiar to their particular branch of Art. The Parma cupola has no eye; the whole is a picture, a Paradiso; but if there had been a lantern necessitating an eye, then a hole through Paradise would look, to say the least, somewhat funny.

[8] Turbini shows a painted cove in imitation of an additional storey to the room in the Palazzo Pubblico at Brescia.—H.S.

In some of the churches decorated at this period the figure composition "leaks" over the architectural mouldings which should enclose it; *e.g.* in the SS. Apostoli at Rome the arms and legs of some of the "Fallen Angels" project over the mouldings, as if they were really falling out of the vault; and the effect, though very striking in a theatrical point, is destructive of the architecture. The same practice of painting legs, arms, wings, clouds, &c., on thin pieces of wood cunningly joined on to the panel and lying over the architectural mouldings, is to be seen in S. Ambrogio at Genoa, S. Alessandro at Milan, the Gesù at Rome, and others.

(8) The Circle or Plane-section treatment will be dealt with later on.

(9) The Powdering with stars is used in the beautiful little Mausoleum of Galla Placida at Ravenna, and a few other small cupolas. This treatment suits any shape.

The above types are often combined as has been shown at St. Peter's, in which ribs, circles, and arches are used; and at Parma Baptistery in which ribs and zones are used; and other cases will suggest themselves.

Alternative Suggestions.

In considering any treatment for the cupola of St. Paul's, we are met at the outset by the charge that this is destroying existing work—a practice which was never followed in the best times—in answer, it may be sufficient to mention that, in *all* of the Stanze of the Vatican, existing work done under the preceding popes was destroyed to make room for the then projected decorations; the question, then as now, being not—what exists—but—can we do better for the building.

A suggestion has been made that the designs of Sir James Thornhill should have colour added to them by being painted over. The question would then arise—whose colour? It is very doubtful if any colourist of reputation would be found to risk it. He would have to alter the composition to suit his colour-scheme; for a composition in monochrome is a very different thing to one in colour. And if a gold background be added, as all authorities agree should be done, then the present monochromes must be still further departed from, for they are not suited to that. All who have studied the great works on a gold background will have observed that the figures must to a great degree silhouette upon it: that portions of it must tell between them, in order that they may "read" clearly upon it. But of the whole eight panels there is only one which would bear a gold ground without considerable alteration, viz. Paul at Athens; the others have groups of figures, close together, making confused masses, which are unobjectionable in monochrome but would require great alterations for colour on gold. Thus would Sir James Thornhill's own work disappear at the hands of those who would make him "beautiful for ever." It is to be hoped that, whatever happen, he will at least be saved from the hands of another Madame Rachel!

Another suggestion is to leave the cupola and go elsewhere. But it must be borne in mind that the cupola has always been approved of for the experiments: Mr. Penrose made two designs for it, a coffered one and an arcaded one; the late Mr. Burges made an arcaded one; and we may infer from their so doing that the effacement of the present work had been contemplated. There have been further experiments the result of which

is now *in situ;* and the question arises, are all these to be thrown away? all the time, thought, and money to be wasted? or shall the work proceed carefully upon the knowledge gained by the experiments?

If, then, it be decided to proceed to decorate the cupola: the examples left to us, from the buildings in the same style, will assist us by the principles we may deduce from them.

Deduced Principles.

On looking through the various types of cupola treatment and their resulting effect upon the interior of the various churches, we notice certain methods of design appeared to have obtained in the most successful cupolas of the best period, which will guide us now. The period is that immediately preceding and contemporary with St. Paul's: Gothic and Indian cupolas have no connection with this subject, and I omitted them from consideration; as we have to deal with a Renaissance cupola, and our study should be from Renaissance examples. In them we observe the following principles:—

(*a.*) Articulation with the subjacent architecture. (*b.*) Suitability in Scale. (*c.*) Suitability to Position. (*d.*) Spaces for Storiation. (*e.*) Simplicity.

(*a.*) *Articulation* is a refinement in grammar which is only felt and used in the best periods of architecture. Of the Gothic style there was none in the Romanesque and Norman period; but in the thirteenth century it ruled supreme, as may be seen in the intimate connection in design between the vaulting-ribs and the pier-shafts, in so many of our beautiful old mediæval buildings. In the early Renaissance there was none; but with increased familiarity and facility it came as naturally as human language becomes refined and polished. It may be shown in many ways: as we are dealing with St. Paul's we may note that as the cathedral is vaulted from an Attic in the four arms of the cross, there seems to be a fitness and rhythm in repeating the attic in the centre or master-vault of the cupola.[9] Secondly: this Attic-storey or pedestal, when provided, gives opportunity for breaks over the pilasters of the peristyle to be of the same width, and axially-disposed over them; which gives good articulation. It would also satisfy the eye at the junction of the two, for another reason: the upright lines of the pilasters and the square heads of the windows make too abrupt a stop under the entablature. In the design for St. Peter's, by Antonio di San Gallo,[10] in which the windows have semi-circular heads, the eye travels up one side, round the arch, and down the other; and the crown of the arch composes pleasantly with the horizontal lines of the entablature. But where the vertical lines are abruptly stopped, as at St. Paul's, there have been several expedients resorted to, to satisfy the eye, of which the most common are:—(*a.*) to place a square block and vase axially over each pilaster, as shown in fig. 7, Illustn. ii; (*b.*) to place a block and statue over each pilaster; and (*c.*) to place an Attic, having its die of the same width as the pilaster below. This last is the most satisfying treatment. Thirdly: between the groups of windows are the stopped-up bays or intercolumniations, forming the eight buttresses of the cupola; these buttress-bays have niches for statues on their inner faces

[9] See *The Builder* of 6th September, 1884, p. 320, and plate.—H. S.

[10] Bonanni, plate XVI.—H. S.

and they are so prominent a part of Sir Christopher's design that they cannot be ignored; and any design for the cupola above must take cognisance of them and "work them up," so to speak, in the design. We may arrange pedestals or similar features in the cupola, over them, to give them an apparent *raison-d'être,* or we may design ribs over them; and either of these expedients gives additional acknowledgment and articulation.

(*b.*) *Scale* is obtained by means of a number of well-proportioned sub-divisions. Whenever Thornhill's work is seen, which is not often in our normal London atmosphere, it dwarfs everything below, by being "coloss" as it was termed; and any variation upon it would only perpetuate the initial blunder. In the rough diagrams in Illustn. iv, fig. 13 shows it; fig. 14 shows the version of Stevens's design which is now *in situ* on the S. side of the cupola; fig. 15 shows an alternative version without ribs; and fig. 16 shows an abscissate treatment: each being one-fourth of the cupola, and all drawn to the same scale. From these it will be seen that Thornhill's panels are 40 feet in height and contain 750 superficial feet; "Stevens-with-ribs" has circles 21 feet diameter, or 350 superficial feet; "Stevens-without-ribs" has circles of 25 feet diameter, or 490 feet superficial, and the abscissate design has semi-circles of 60 feet diameter or 1400 feet superficial.[11] Thus the Thornhill and abscissate designs dwarf the cupola, but the Stevens design increases the apparent size and adds dignity to the fabrick.

(*c.*) *Position:* the cupola, as the central feature of the crux, should contain important features axial with the four arms. This can be accomplished in the storiation, as explained later on. Again, since the view of it is gradually unfolded, as the worshipper walks up the nave, any design should be arranged to suit this.[12]

(*d.*) *Storiation:* the spaces for this should be ample, but not so large as to dwarf the cathedral. The problem is essentially an architectural one, and the architect must judge of the sizes suitable to each building. The figure compositions must be kept strictly within their architectural framework; and no legs, arms, wings, or clouds, allowed to "leak" over the mouldings.

(*e.*) *Simplicity:* this and sublimity are so nearly allied that it is impossible to have one without the other.

Possible Treatments.

Passing quickly in review the various treatments, we note that the cupola of St. Paul's is not abscissate and there are no penetrations, that it is oculate, and that it is supported by the peristyle as before described. These are the data of the problem.

(1) *Ribs.* There might be a narrow rib over each pilaster: this would do, inasmuch as there would be a sufficient number of them (32) to give the idea of a polygon of an infinite number of sides or circle; but there are three objections—(*a.*) the buttress-bays containing the niches would be ignored, (*b.*) the space for storiation would be too small, and (*c.*) it would be too much like a "smaller edition" of St. Peter's. Secondly, there might be ribs over a smaller number of the pilasters—say those which flank the niches:

[11] It will assist the judgment in considering these dimensions, if it be stated that each of the spandrail or pendentive panels has a superficies of 240 feet.—H.S.

[12] See *The Builder*, 9th December 1882, page 742.—H.S.

this is done in the design now *in situ,* further each pair of them is joined together at the base, and by small knot-circles, thus forming one broad rib over each buttress. These broad ribs are entirely satisfactory, as giving the appearance of supporting the lantern at summit, as giving a *raison-d'être* for the buttress-bays, and as forming simple aspiring lines sweeping up the curve of the cupola-section. They are sufficiently pronounced to steady the vision-circles without cutting-up the surface into parts. To interpret one part of a man's work by another part, has always been held to be safe criticism; and applying this to Wren—interpreting Wren *by Wren*—we find that, since he has applied Ribs, each articulating over a break in the Attic, in the semi-cupola over the Apse, we should be justified in designing ribs for the great cupola, only they should be *wider* to suit the increased diameter and distance; and this would tend towards unity and simplicity of treatment through the whole building.

The size of the cupola, 315 feet circumference, by 72 feet in developed height, with a superficies of about 16,000 feet, makes radial figures unsuitable unless of such gigantic dimensions as would dwarf the architecture.

Intersecting ribs are possible, but would not accord with Wren's treatment of the vaulting below.

Parallel ribs are not possible, because the cupola is not abscissate, and therefore there is no datum plane, and the cupola is not polygonal, and therefore no datum mitre to be parallel to.

(2) *Marginal Panels,* though sometimes useful in giving greater emphasis to the bounding-lines of a composition, are not necessary at St. Paul's; and any additional unbroken circle would make bad proportion, and suggest that the artist, finding the space too great for treatment, was reducing it by this expedient.

Zones are objectionable for the manner in which they reduce the height of the cupola into measurable littleness. Ribs give a series of *countable* though not measurable parts, but zones are *measurable,* inasmuch as, assuming the human figure as our measure, we multiply the number of zones by the height of a man—say 6 feet—and assess the height; and thus the grand expressions of height and mystery evaporate. In addition to making a series of measurable and countable steps on the surface of what should be immeasurable and uncountable—the idea of a number of figures ranged in a series of ranks round a hole, is a very artificial treatment of the human figure: the distance would prevent any individuality, and the whole would be confused: the "*lunga* "*riga*" of Dante[13] is beautiful in its place, but all the poetry vanishes when it is described by compasses. The cupola as a whole must be viewed by a spectator standing inside the circle of the dome; and the effect of zones is shown in the rough diagram, fig. 20 in Illustn. v. The cathedral at Florence was decorated with zones in the Decadence; and its failure has been a byeword among the Italians for the last 300 years.[14]

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[13] V. 47.—H.S.

[14] The apologists for zones speak of the cupola "floating" over us, &c.: the stone lantern above [weighing 700 tons, and as large as a church tower], and the windows in the brick cone, as seen through the eye, are surely prosaic enough. Let us have poetic feeling in the Storiation, but keep the architecture simple and real.—H.S.

(3) *Coffering* was at first intended by Wren at St. Paul's; and is shown [Illustn. viii] on his model, and in the engravings published shortly after;[15] and there would have been a fitness and unity in coffering the cupola just as he has coffered the first bay of the four arms of the cross—*but* for the fact that there would be a want of interest in treating a grand cupola with a mere diaper of coffers. If Wren had designed coffering as the best he thought for his dome, and if it were now *actually in existence,* we should hesitate to alter. Happily it is not in existence; and we can do now something worthier of him and of the great church. Coffering may be made more interesting by what I term "omitted-reticulation," *i. e.* supposing the stiles or frames of the square coffers to form a reticulation or net; we omit some portions, and make cruciform panels. The cupola of the church of SS. Trinità dei Pellegrini at Rome is coffered in a similar manner, except that the large panel is square, occupying nine of the meshes. Wren has also coffered the cupola of his other masterpiece in an analogous manner, as may be seen at St. Stephen's, Walbrook. Still we may assume that coffering has not sufficient interest and importance for such a dome as that of St. Paul's.

(4) *Axial Panels and Axial subjects with ribs* may be made to come fairly well if well articulated; the chief objection being the lack of unity or keeping with the peristyle, or the other sub-panelling in the building.

(5) *Arches* might be used in three manners. Firstly, from pilaster to pilaster, over each opening, as at St. Peter's; but this would not compose well over the buttress-bays with niches. Secondly, between the broad ribs before-mentioned and spanning over each group of three windows; but these would be so large that they would enter into competition with the eight great arches below, and destroy the scale.[16] Thirdly, arches in tiers, as in the Sepolcro Chapel in San Stefano at Bologna, which served as motive for the two arcaded designs before-mentioned; but this treatment has the same objection as zones—of cutting-up the cupola into heights or steps. Hence we may assume arches are unsuitable.

(6) *Scenic architecture* is certainly among the possible treatments; but it would be a degrading of our noble cupola to perpetrate any more upon its surface.

(7) *The Correggio style,* though allowable in a *small* cupola, *unpierced* by an eye, is unsuitable to St. Paul's, with its 16,000 feet of surface, and its eye and lantern above.

(8) *Plane-section:* this is the characteristic treatment of a spherical cupola: the zone treatment may be applied to a *cone;* the narrow rib treatment to a *polygonal*

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[15] It is similar to the design by A. di San Gallo for St. Peter's, as shown in plate XVI of Bonanni. The peristyle was to have thirty-two pilasters equally spaced, and the stiles of the coffers were about the same width and axially over the pilasters. Michelagnolo altered this to the sixteen pairs of pilasters, as we now see them.—H.S.

[16] They would make eight semi-circular panels, each 26 feet long, by 13 feet high, with about 270 feet superficies. Since the above was written a friendly suggestion has been made to have *four* arches only, as if the cupola were abscissate; this would make each panel about 60 feet long, by 25 feet high, with a surface of about 1400 feet! which, though they would provide large spaces for the painter, would ruin the effect of the cathedral by their enormous size. The relative size of this is shown in fig. 16 [Illustn. iv], and in fig. 19 [Illustn. v].—H.S.

cupola; but the large circle is the section of a sphere, and of *a sphere only.* This was the invention of Stevens: it is his contribution towards the solution of the problem. I have always looked upon the circles as the essential part of his design—circles with ribs or without ribs—but—*circles!* If we cut a sphere by a plane in any direction the result is a circle; and therefore I term this the "plane-section treatment."

Of course circles have been used in the decoration of cupolas for a long time. The circle is the most natural shape to use in the sub-panelling. Italy is full of circular panels, but they are *between the ribs,* and not articulated with them; they are subordinate features put in to fill up, as may be seen in fig. 6 [Illustn. ii]. Stevens adopted *circles* as his *main features,* and only used ribs to steady them, to knit the whole together, and to articulate with the subjacent architecture.[17]

Further, in addition to being the characteristic shape for hemispherical cupolas, the circle is the characteristic shape for *visions and imaginings:* we see things in circles—we sketch things in circles; we vignette our sketches; and it is only when we have to think of the *frame* that we attempt to fill up the angles. A painter having a quadrangular canvas to fill does it—but the essence of his picture is in the circle.

Another advantage of the circle is that however much other geometrical figures may be distorted by being seen in perspective on concave surfaces, the circle becomes an *ellipse only;* and thus gives simplicity and sublimity.

(9) *The Powdered Treatment,* though appropriate in a small unpierced cupola, is unsuitable in St. Paul's; and moreover lacks interest.

Distance and Gloom.

The question of suitable treatment is closely affected by the existing Distance and Gloom. The *Distance* is so much greater than any obtainable in a studio, that after my figures were painted full-size, I had them hung down from the top of a house, and went eighty yards down a road to look at them; and when improved, as I then thought, I further had every piece taken to St. Paul's and tried up as near in situ as practicable. Ropes were tied to the corners, and the piece was let down from the eye of the cupola by two men, and then two other men pulled the lower ropes through the windows of the peristyle, thus "flying a kite" with the piece, or having it hung from the Whispering Gallery. Then I found that still greater simplicity of contour and distinctness of colour were necessary. And the gold ground, permeating everything, I hold to be absolutely essential. I say *permeating everything,* the vision-circles as well as the ground outside, and the ribs also. The architectural framing will thus have just sufficient weight to mark off the various groups or episodes in the grand cycle of storiation;

[17] The left-hand half of the diagram, fig. 14 [Illustn. iv], shows the design at present *in situ:* the right-hand half shows a variation suggested by one of the sub-committee some years ago. It will be observed that the circles in the latter are articulated, not with the ribs, but with mere margins of the [cotised] ribs. I did not adopt it, because, firstly, I am of opinion that the whole cupola should be of the same importance, in order to preserve its homogeneity; secondly, because in this treatment the circles, which should be the chief idea, would be thereby made secondary to the ribs, and become mere sub-panelling; and thirdly, because its adoption would make the cupola too much like that of St. Peter's.—H.S.

but the unbroken surface, which is the glory of a cupola, must be preserved. And *gold* because no other treatment can give so noble an effect in the *gloom*. The clearness at the base of the cupola is necessary; but I propose to *lose colour* gradually as it goes up, so as not to take away the splendid mystery of that grand dome. In connection with the mystery and resulting space; undoubtedly it exists there now: but there is all the difference between disappearing in the dirty dinginess of Thornhill and melting into the golden light described in Dante's vision; and the mystery of Heaven would replace that of darkness.

Plaster Treatment.

The architectural lines of the cupola would allow of the use of fibrous plaster. This would make true lines and manageable spaces for the mosaicist. Its use would make a saving of about £6000 in the cupola. Of course economy alone is a sorry principle when dealing with our noble cathedral; but when it coincides with appropriate treatment, it may be taken into account.

Alternative Treatment.

Some years ago it struck me that the circles being *the* idea, the ribs might be omitted; and so I made the rough sketch of the idea. I showed it to the sub-committee about two and a half years ago; and while some of the members thought it might be a good treatment, they felt that they had no power to consider it, as their report made in 1878 only contemplated ribbed designs. I thereupon rolled it up and consigned it to the cupboard. Since my version has been fixed full-size *in situ*, the rib-treatment has been somewhat criticized by those credited with judgment in the matter. Hence, without giving my own opinion, I pulled out the old idea, had it furbished up, and here it is—rough enough, and crude enough—but sufficient to show to professional experts. The main lines of it are shown in fig. 15 [Illustn. iv], and in fig. 18 [Illustn. v].

Figure Treatment.

The quotation below appears so appropriate that no apology will be necessary for its introduction. The following are the chief rules formulated by Mr. Oldfield:—

1. To arrange all the subjects in formal, if not actually geometrical, compartments, distributed equally around the vault, in accordance with its structural uniformity.
2. Where the dome, like St. Peter's, is a prolate hemispheroid, not a hemisphere like the Chigi, to keep the most important subjects in the lowest part, nearest the eye.
3. To make the number of figures sufficient to give an idea of great space.
4. To keep the scale of the figures at once large enough to secure distinctness to each, yet small enough not to diminish by comparison the size of the vault, or bring the upper and lower parts of the same figure at perceptibly different angles to the eye.
5. To design the figures with severe statuesque simplicity (though not, of course, with archaic conventionality), and as far as possible in one plane, which should be at right angles to the sight, not receding, as if seen "di-sotto-in-su."

6. To execute the mosaics roughly with large tesseræ, without attempting that minute elaboration of tint or chiaroscuro which was practised by the Vatican mosaicists when imitating oil paintings.
7. Though not essential, it is highly advantageous to adopt, as is done at St. Peter's, contrariwise to the usual cinquecentist practice, the Byzantine system of gold backgrounds, which keeps the whole decoration flat, like the surface of the vault itself, and diminishes also the absorption of light.[18]

STORIATION.

It will be doubtless remembered that the Scheme of Storiation, to which we all worked, typified the Final Consummation as described by the Apostle John in the Revelation. This has been adversely criticized; firstly, as giving subjects which would be difficult to treat so as to be intelligible at the great distance; and secondly, as containing a succession of [8] representations of Christ; the numerousness of them taking away the dignity which a smaller number would give.

Some have suggested that four of the opening sentences of the "Te Deum" should be adopted; forgetting that these are only *opening sentences,* and that the Te Deum is not a jubilant hymn of triumph but a prayer :—

We therefore pray Thee help Thy servants

and, as such, it is more suitable for a lower level in the cathedral than for the crowning feature or cupola.

Others again have suggested the different grades in the Hierarchy of Heaven as arranged by Dionysius—each in a different zone; a system which would result in a series of undistinguishable stripes round the cupola, before observed.

Thinking the whole over, some time ago, it appeared to me that unity would be given to the whole building by having one idea running all through—one central Figure always present figuratively or by implication, and this—the Founder of the Faith. So keeping to the traditional appropriation of the Nave to the Old Testament History—the times of *Preparation and Promise;* the Choir and Chancel—to the New Testament History of the *Life and Passion;* and the Western wall, as the people leave the building, for the Last Judgment; we would represent the *Victory and Ascension* in the Cupola. Thus Christ is the name which consecrates and dominates every part of the Fabrick: in the Nave, Christ the Promised; in the Choir, Christ the Saviour; in the Cupola, Christ the Conqueror; and towards the West, Christ the Judge. It is right to state clearly and emphatically that I was not asked for this, and I thought it out entirely on my own responsibility. I have not had the opportunity of submitting it to Mr. Oldfield, who is in every way the best judge in such a matter; and I give it subject to consideration hereafter. But if such a scheme should be considered and approved: the belt or cycle of vision-circles, could be arranged as follows :—

The Western circle—the Empty Sepulchre, with the Angel.

The adjacent circles—the one, Disciples going towards it; the other, the Women.

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[18] *St. Peter's and St. Paul's,* by E. Oldfield, M.A. Longman, 1876, pp. 76-78.—H.S.

The Northern circle—the Supper at Emmaus.

The Southern circle—the " Noli me Tangere."

The Eastern circle—the Ascension with Angels, but no human figure in it.

The adjacent circles—the one, the Disciples (men); the other, the Holy Women.

This would be one story all round: commencing with the empty tomb, travelling round each way, and culminating in the Ascension, men on one side, women on the other. There need be only *three or four* figures in each circle, and hence *clearness;* Christ would be only *thrice* represented, hence *dignity.* He would be the great central figure on the East side of the dome, ever facing and welcoming those who look steadfastly towards that day when all mankind shall face the East.

The belt, or zone round the eye, could in this scheme have the Cherubim and Seraphim. The thrones would be occupied by the 12 Apostles as Witnesses to the Christian verities; and the field of the cupola would be occupied by the Heavenly Host of Praise and Thanksgiving. It will be seen that to arrange 12 figures at 8 points it is necessary to have 4 pairs, these I would place alternately with single figures, a mode of arrangement which I have seen in Italy. This treatment, instead of being a blemish or looking odd, would enable us to give greater importance to the *four* axes and to emphasize the crux. At St. Peter's at Rome, there are four arches and *four only*: at St. Paul's we have eight, which is not so good a number for a Christian church.

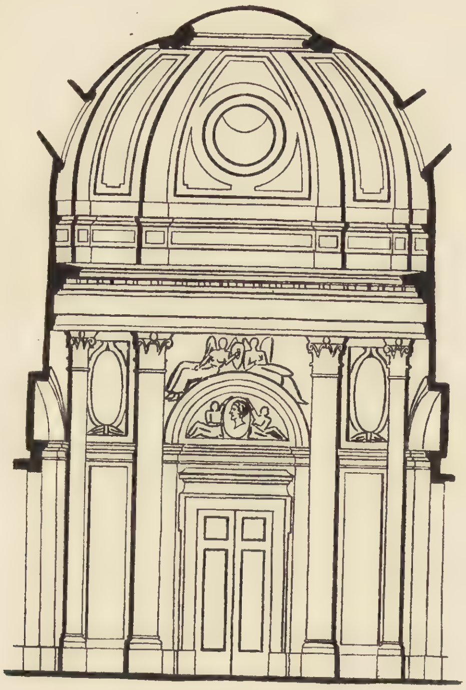
I venture to think we may lay down another canon: that any scheme devised for any particular arrangement in the subjacent architecture, should suit that arrangement and no other. The fact of agreeing equally well over a dozen different drums, so long as they were of the same diameter, is convenient in dish-covers which serve indifferently so long as the size is right; but it is scarcely the thing in so important a feature as a cupola, which, as we have so few in England, should have individuality of treatment; so we will agree that we do not wish to have one which can be lifted off and on to other churches. This canon condemns all treatments which are not articulated, and all which are mere copies.

As regards Originality: this is entirely in favour of Stevens. We remember the saying of Michelagnolo to the cupola at Florence, when thinking out his design for St. Peter's:—"Like thee I would not";—and this would be the feeling of all great minds. We do not want to make our St. Paul's like a reduced copy of St. Peter's at Rome, or the cathedral at Florence; and fortunately we have the opportunity of using an entirely new treatment. It will further be seen that of the several possible treatments it is in all respects the most appropriate, and in some respects the *only* suitable treatment.

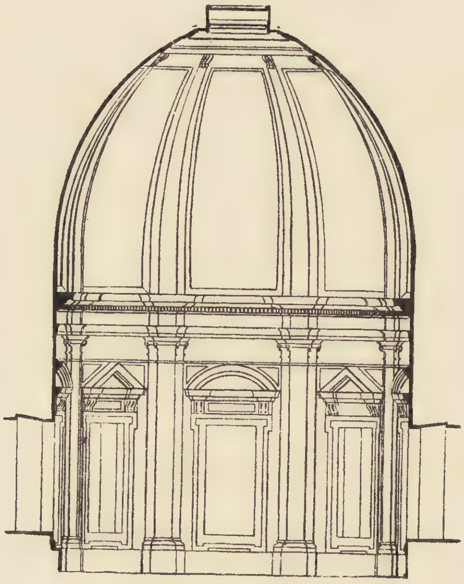
Thus, to sum up, Stevens's design has the advantage in point of:—Articulation to the existing work; Scale giving size to the fabrick; Position suitable for view from the pavement; Storiation provision of spaces: that it suits the Distance by its simplicity; that it provides for the Gloom by the gold ground; and lastly, that it possesses an Originality which does not exist in any modern cupola.

HUGH STANNUS.

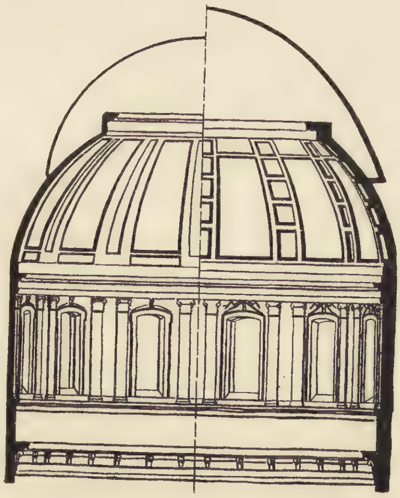
II INTERNAL TREATMENT OF CUPOLAS (i).



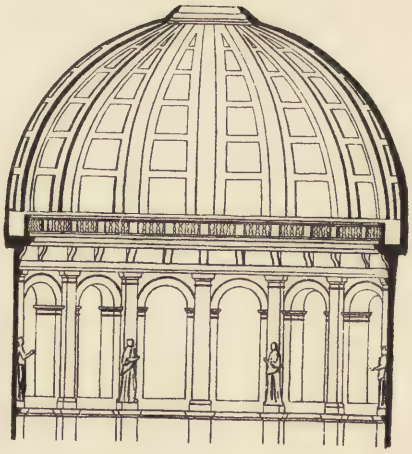
1. RIBS: GOOD ARTICULATION.
S. LOUIS, METZ.



2. COTISED RIBS, SISTINE CHAPEL
IN S.M. MAGGIORE, ROME.



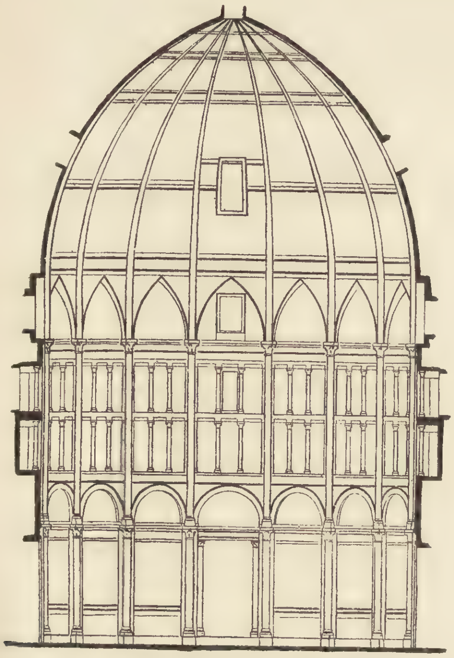
3. RIBS: PANELLED AND COFFERED.
THE INVALIDES, PARIS.



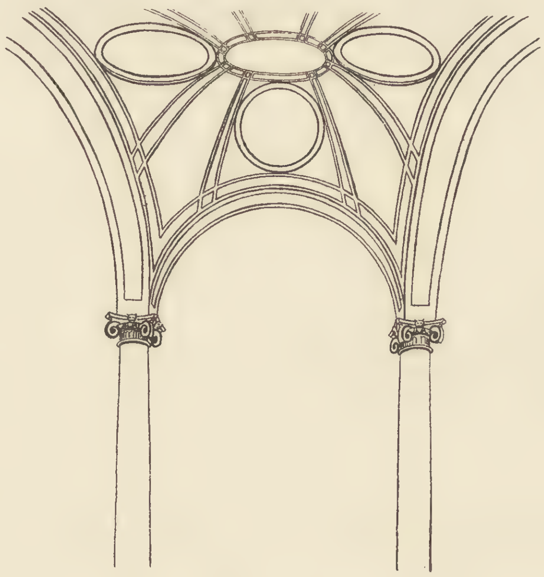
4. COMBINATION OF RIBS AND COFFERS.
S.M. DELLA SALUTE, VENICE.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

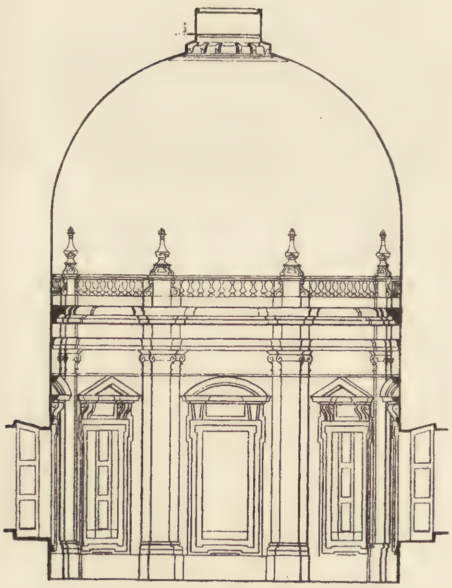
II INTERNAL TREATMENT OF CUPOLAS (ii).



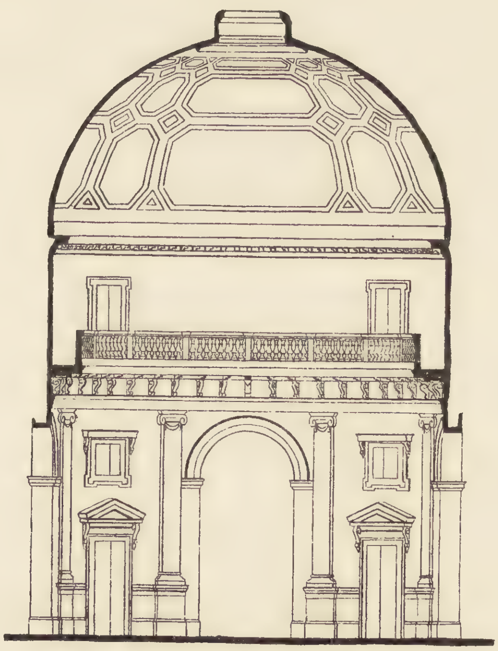
5. RIBS AND ZONES.
THE BAPTISTRY, PARMA.



6. RIBS IN ABSCISSATE CUPOLA, AND
CIRCLES AS SUB-PANELLING.
THE PALAZZO BRASCHI, ROME.



7. ATTIC WITH VASES
THE BORCHESE CHAPEL IN S.M. MAGGIORE, ROME.

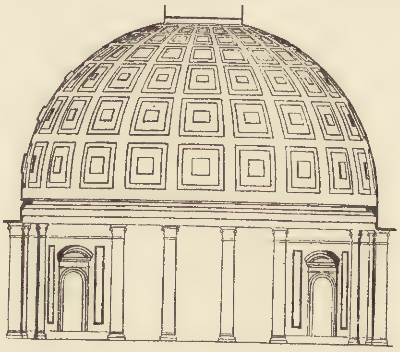


8. COFFERING; OCTAGONAL UNEQUAL.
VILLA ALMERICO, VICENZA.

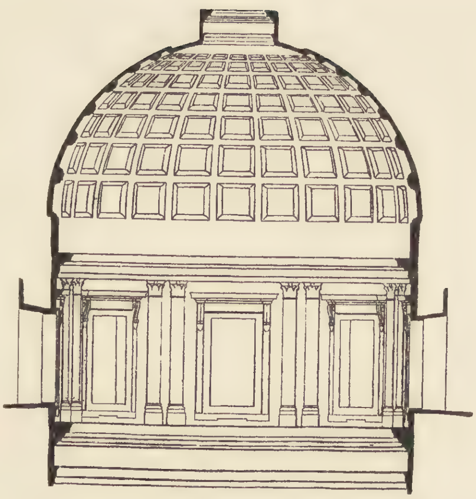
C.F. Kell, Photo-Litho. Castle S^t Holborn, London, E.C.

II INTERNAL TREATMENT OF CUPOLAS (iii)

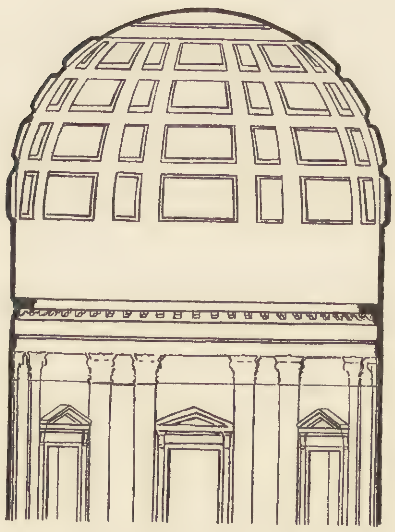
9. COFFERING. S.M.MADDALENA, VENICE.



10. COFFERING, PELLEGRINI CHAPEL, S. BERNARDINO, VERONA.



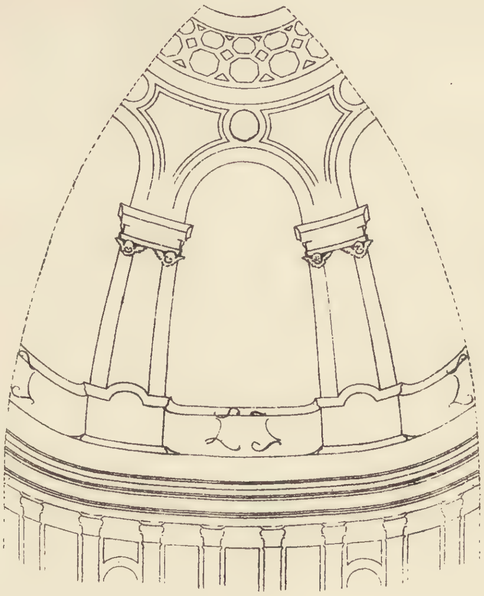
11. COFFERING; BADLY ARTICULATED CORSINI CHAPEL S.G. LATERANO, ROME.



12. COFFERING; UNEQUAL, FOR ARTICULATION. S.M. DE CARIGNANO, GENOA.

J.P.Kell. Photo-litho [illegible]

II INTERNAL TREATMENT OF CUPOLAS (IV).



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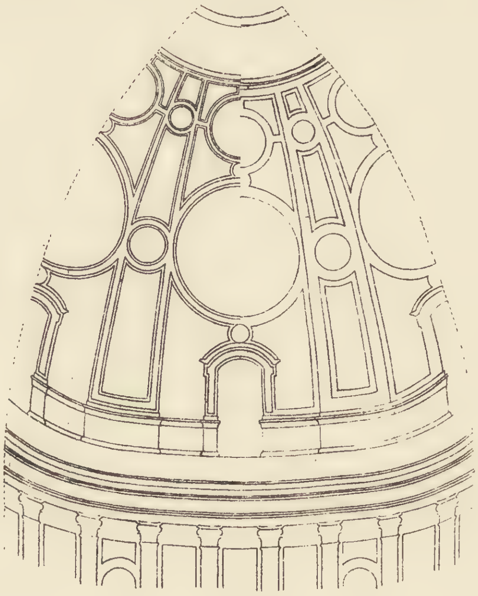

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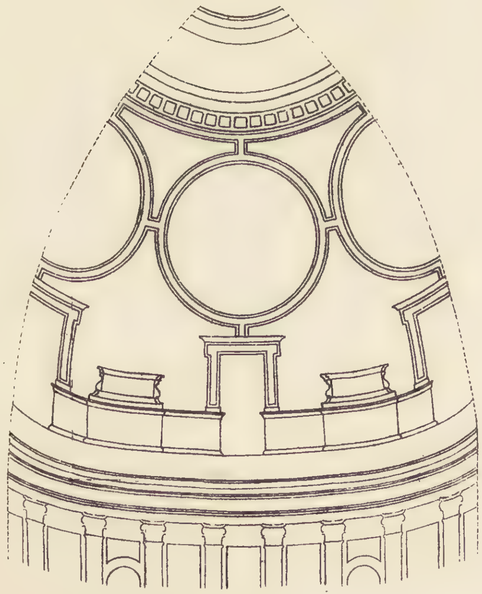

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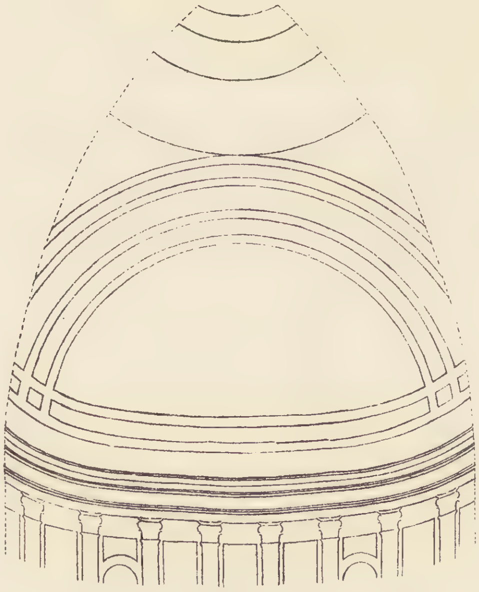


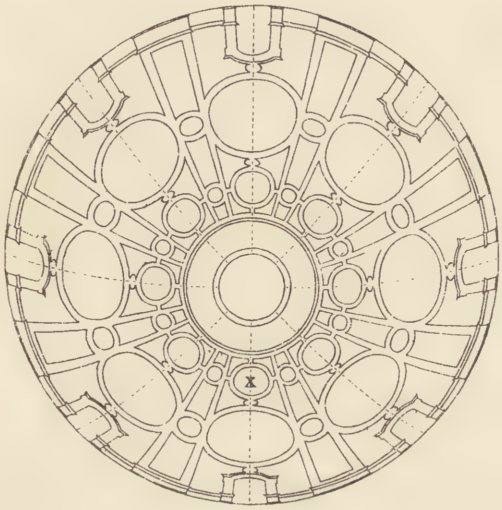
16

SCALE OF 10 0 10 20 30 40 50 FEET

C.F.Kell, Phooto-Litho. Castle St Holborn, London, E.C.

TRANSACTIONS OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS, VOL. I, NEW SERIES.

II INTERNAL TREATMENT OF CUPOLAS (V).



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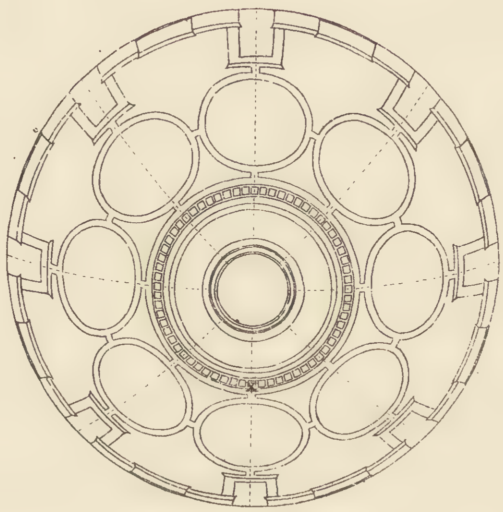

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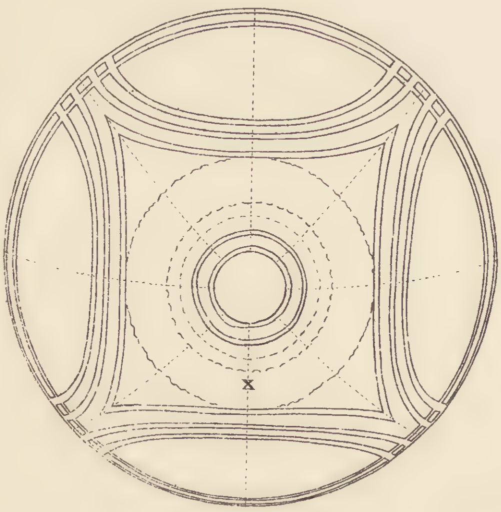

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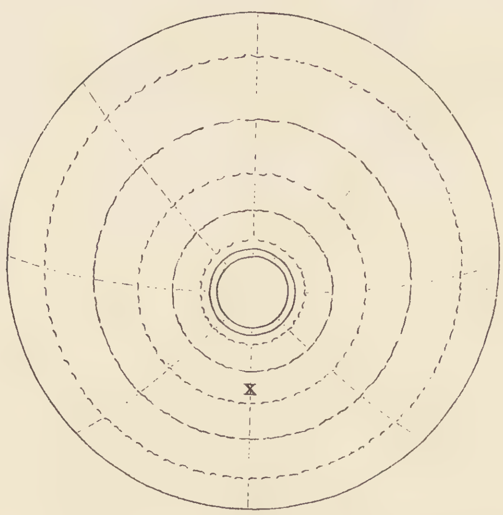
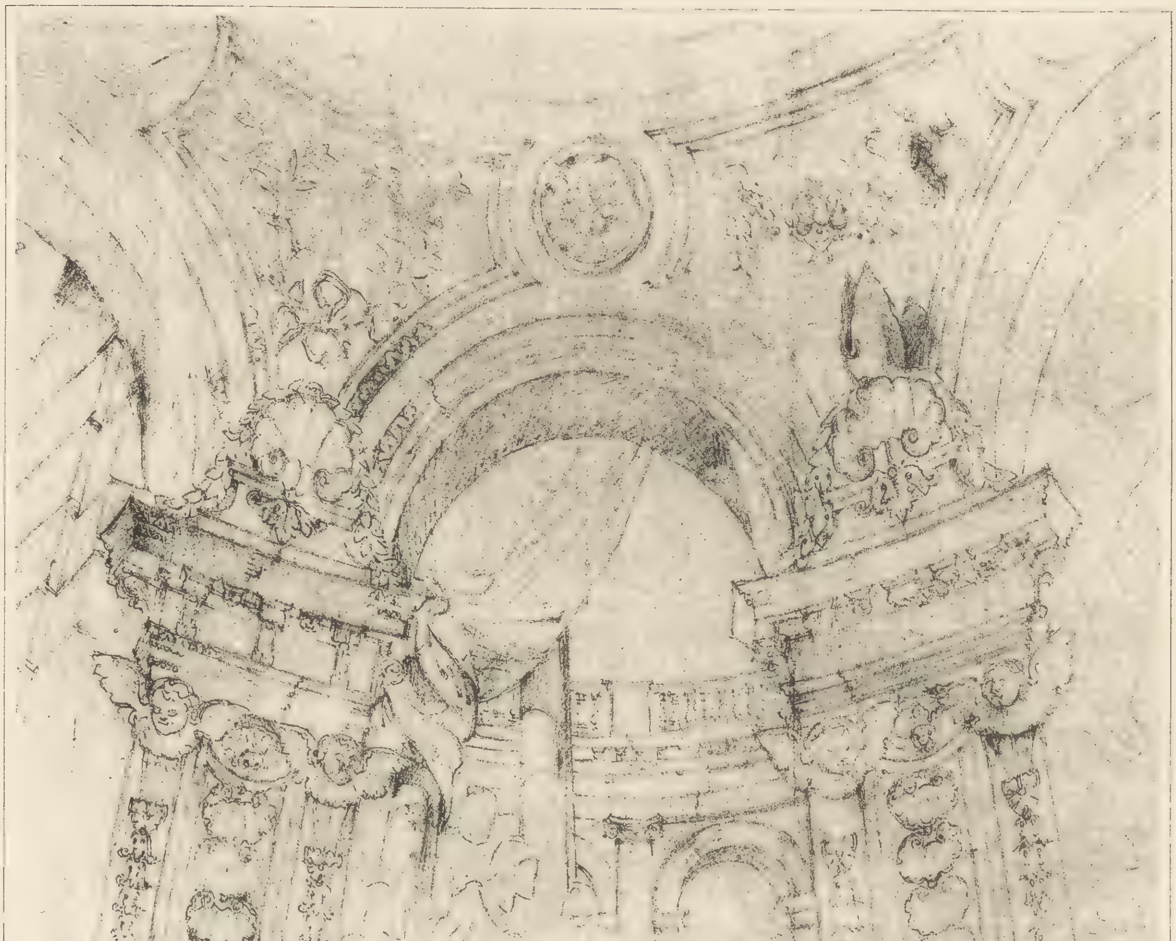


20

DISTANCE OF EYE 4¼ INCHES.
FROM THE POINT MARKED X.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

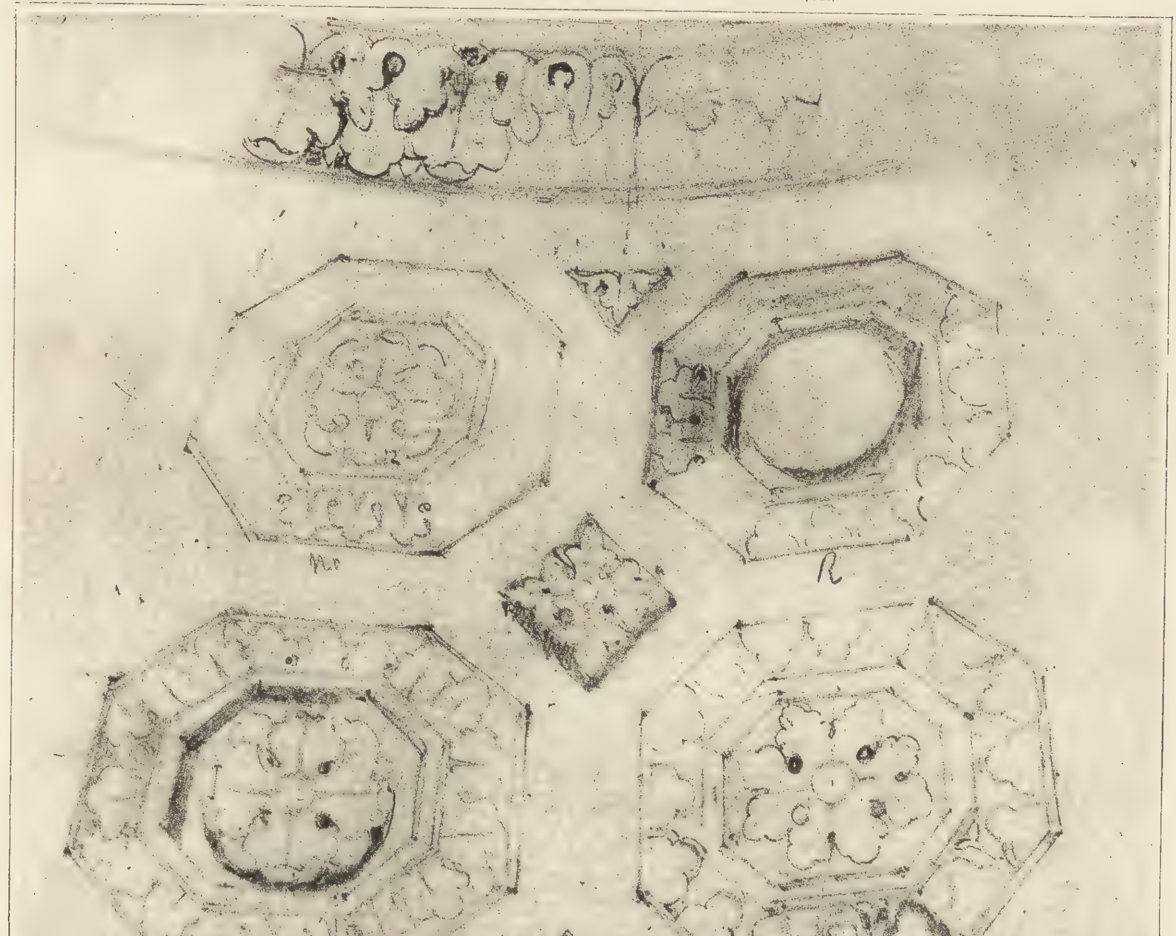
. II. INTERNAL TREATMENT OF CUPOLAS. (VI)



INK-PHOTO, SPRAGUE & Co LONDON.

21. REDUCTION OF A SKETCH, BY THE LATE MR R.W. BILLINGS, OF THE DECORATION OF THE DOME OF ST PAUL'S CATHEDRAL, AS PAINTED BY THORNHILL.

II. INTERNAL TREATMENT OF CUPOLAS. (VII)



22. REDUCTION OF A SKETCH, BY THE LATE MR R.W. BILLINGS, OF THE COFFERS PAINTED BY THORNHILL, AROUND THE EYE OF THE DOME OF ST PAUL'S.

II. INTERNAL TREATMENT OF CUPOLAS (VIII)

FINE PHOTO SPRAGUE & Co. LONDON

23. WREN'S MODEL OF ST. PAUL'S CATHEDRAL.

REDUCED FROM A WATER COLOUR DRAWING BY THE LATE MR. E. C. SAYER

III.

SEMPER'S THEORY OF EVOLUTION IN ARCHITECTURAL ORNAMENT. By his Pupil, LAWRENCE HARVEY, *Associate;* former Student of the Polytechnikum, Zurich; Medallist of the École des Beaux-Arts, Paris.

[Read on Monday, 15th December 1884, Ewan Christian, *President*, in the Chair.]

PERHAPS many of my British colleagues have never heard of Semper, yet in Germany his name ranks as high as Wagner's; such is the difference between the popularity of music and that of architecture that even the minor stars of the one art are known all the world over, whereas the fame of the greatest architects hardly ever goes beyond their own country. I feel sure that of all our brother artists in Paris very few have ever heard of Barry, Scott and Street. I speak advisedly, for I have tried the experiment. The works that Semper has either carried out or only designed are certainly of the highest merit, but do not suffice to explain his unique position amongst his countrymen, who reckon him as by far the greatest architect they ever had, and, taken all round, one of Germany's brightest geniuses. This exceptional esteem is principally due to Semper's writings, of which his book, *Der Stil*,[19] is the most important, containing as it does the substance of his former works.

Semper[20] was born in 1803 at Hamburg. He was the son of a wealthy wool manufacturer, his mother was a woman of Elizabethan strength of character and had doubtless great influence on her son, who gave very early signs of an indomitable will. Semper completed his studies most brilliantly in the College of Hamburg (the Johanneum); and to them are due his love for the ancients and his exceptional knowledge of Greek and Roman literature. His favourite author was Seneca from whom he borrowed the motto which guided him through life: "Non fuerat nasci nisi ad has,"—that is to say, he cared not to live unless he achieved great things. Semper had thought of the theory of evolution so far back as 1826 when visiting the zoological museum at Paris, and this theory he attributed to Seneca who indeed anticipated Darwin when he wrote in his 90th epistle the following which I quote with Italian vowels; "Nat*u*ræ est enim, pot*io*ribus deter*io*ra

[19] *Der Stil in den Technischen und Tektonischen Künsten oder Praktische Aesthetik. Ein Handbuch für Techniker, Künstler und Kunstfreunde von Professor Dr.* Gottfried Semper *K.K. Oberbaurath und Mitglied des Baucomité für die Museen und das neue Hofschauspielhaus in Wien.* 2 vols. 8o. Munich 1878.

[20] See the TRANSACTIONS, 1878-79, page 233, for an obituary notice of "The late Gottfried Semper of "Vienna, *Hon. Corr. Member*," by Professor Donaldson, *Past President.*

submittere. Mutis enim gregibus aut maxima corpora praesunt aut vehementissima,"—which can be translated thus: it is the law of nature that the weaker being should give way to the fitter; for the biggest and the strongest preside to the change of the herds. On leaving the College of Hamburg, Semper was enthusiastically attached both to literature and mathematics; his father wished him to study law, but he eventually joined, in 1823, the university of Gottinguen as student of mathematics; he was then 20 years old. To these high mathematical studies, which he followed for two years, is due no doubt a mathematical way of explaining art questions, a way which will surprise you; for instance, take Semper's definition of style: it is a formula taken from integral calculus $\gamma = F(x\ y\ z, \ \&c.)$ in which $\gamma =$ style. Function $F =$ purpose, and the variables $x\ y\ z$ are the various conditions which influence the accomplishment of the work,—materials, tools, religion, civilization, personal character of artist and patron; a definition which may appear obscure to the uninitiated, but which is eminently clear and comprehensive to mathematical students, for we know that if any of the variable quantities, $x\ y\ z$, *&c.*, vary ever so slightly, the value of the function γ may vary from the infinitely little to the infinitely large $+$ or $-$, but γ yet obeys the same law. But if the function F changes to another function, say the function U, then the character of γ is essentially changed. All drinking glasses have the same character, however much their shape may vary according to their being made out of glass, metal, wood or leather, or having been fashioned by Greeks or savages.

When Semper left the University of Gottinguen, he wished to become an artillery officer, but for some reason or other he was prevented from doing so and turned to architecture, the career in which he was to distinguish himself.

In 1825 he joined the School of Architecture of Munich; he was then 22 years old! a clear proof that, to rise high in our profession, an early beginning is not the best way, that it is better to wait until you have completed your education as a man of general culture. As pupil of the Munich architect Gärtner, Semper got acquainted with Gothic architecture and, with the enthusiastic energy he put in all he did, he undertook a book on Gothic buildings, for which he went to Regensburg to make drawings of the cathedral. In Regensburg he got involved in a duel and had to leave the country; this determined him to go to Paris. He remained in Paris from 1826 to 1830, that is from the age of 23 to 27. His master in Paris was Gau, to whom Semper really owes his artistic principles, as may be seen from a letter written by Gau to Semper on the dedication of his first book. He writes:—" This book is a warrant that you have understood my teaching and I entirely " agree with everything it contains. I am now richly paid for my labour and can hope " that the seed I have sown will bring forth a plentiful harvest."

Semper left Paris with one of his French comrades, named Jules Goury, and travelled for three years in Italy, Sicily and Greece. On his return, he published his observations on the polychrome architecture of the ancients, which got him the friendship of our eminent master, Professor Donaldson, and of the celebrated architect Schinkel. Through the recommendation of the latter, Semper was appointed Professor of Architecture at the Royal Academy of Dresden, 17th of May 1834.

Semper was then 31 years old, and a splendid career opened itself before him, for,

in Germany, such a post meant the patronage of the King and eventually the carrying out of the great buildings of the Kingdom. What he did with his exceptional opportunity may be seen by the numerous buildings he erected in Dresden.

In 1848 Semper assisted the revolutionary party in erecting barricades and had to fly for his life. It has never been understood what induced Semper to take such a fatal step; some say "that it occurred quite accidentally." He was passing by as the people were clumsily erecting a barricade and he observed to them that that was not the proper way to do it, and he showed them how; others speak of his friends having tempted him to join the rebels; for my part, I believe that Semper had been checked in one of his pet plans by some of the councillors of the King, and being a man of overbearing and violent temper he joined in the revolt.

For to Semper, anybody who differed from him was an enemy; Kugler, Thiersch, Viollet-le-Duc, and many others, were roughly handled by him. Neither was he indulgent in judging of the works of other artists; I met him one day in front of the Paris Opera House and asked him: What do you think of this building, Professor Semper? "Sehr schlecht," very bad, was his answer. A few years afterwards, an eminent French architect, who had been to Dresden, returned the compliment. I asked him his opinion of Professor Semper's Opera House, and he said: "Quant à son foyer "circulaire je ne le lui pardonnerai jamais, on s'y promène comme un écureuil dans sa "cage. J'aime mieux son musée, quoique ce ne soit pas de l'architecture comme je "la comprends."

In London Semper took a part in the great Exhibition of 1851, and was appointed Professor of Design at Marlborough House (then the Department of Science and Art), which he left for the Directorship of the Swiss School of Architecture. He went afterwards to Vienna to carry out some of the great public works of that town; he left it in ill health, and died in Rome, the 15th of May 1879. He lies buried in the Protestant Cemetery, at the foot of the Pyramid of Cestius in that city, which represented all that was most dear to him in his lifetime.

Semper held in slight esteem theoretical art-teachers, and did not care to be limited in his appreciation of art and his freedom of designing by their pedantic rules. In times when art was really living, treatises on æsthetics were purposeless. People appreciated beauty instinctively, as in the epochs of Pericles and the Renaissance, and put refined taste into everything, even into their every-day tools and utensils. Our times are unfortunately adverse to art. In our lives we have no room for meditation; we run from place to place, and, by means of the printing press, we are in communication with all countries and all ages, we remain confused by the number of impressions we daily receive and are unable to suitably appropriate. Very different were the Greeks, who for centuries kept to one mode of architecture, which they modified with the progressive conservatism of men to the manner born. Unfortunately our styles of architecture change like Paris fashions, and lack stamp and character. Indeed inventions follow one another so rapidly that men have hardly time to give them the artistic dress which suits them. Inventions

have not even improved technical methods. What have the painters done with the unheard-of riches that chemistry has presented to them ? The old pictures in oil, be they Flemish or Italian, have endured to this day; the works of most modern painters are dilapidated before their authors' demise.

In the great periods of art, artists and artisans worked up every detail of their craft; the blight of the division of labour did not then dwarf thoughtful artists to human machines. To these circumstances unfavourable to art, I beg to add one which Semper has not mentioned, and yet appears to me more important than all the rest: I mean the severance of art and religion, which has for three centuries been one of the characteristic features of protestant countries. Art loses thereby its most ideal object, becomes simply a means of enjoyment, instead of being, as with the Greeks and other peoples, the principal means of edification. By ceasing from being an element of worship, art has lost also its popularity; it may be a source of pleasure and vanity to a refined minority; but the denizens of Whitechapel and Seven Dials know nothing about it.

When a man is in good health nobody thinks of giving him medicine, but when he has lost his natural appetite he needs some remedy. Semper, instead of giving our present anæmic generation a pill in the form of a treatise of æsthetics, prefers to brace us up by a good system of hygiene, and invites us to review with him the development of art from its beginnings, wherein he critically investigates all the works of the peoples who preceded us. We shall find therein health and liberty; no fixed rules but discernment. For instance, instead of giving canons of proportion for the orders of architecture, as former writers have done, he compares the various buildings in which the same order appears, and explains the why and wherefore of its modifications, leaving his reader quite free to select for himself the proportions most suitable to his purpose.

As Semper was convinced, that the beginnings of art are to be found in the humble crafts which supply the necessaries of every-day life, and that even now they have the greatest influence in forming our taste, he was one of the first to maintain the importance of founding museums of art work.

I do not know what Semper has had to do with the formation of the South Kensington Museum, but I am surprised to find that his dream was first realized in England. Is it too much to believe that in private intercourse with the eminent men who have started the art-revival of England, Semper has had many an opportunity of imbuing them with his ideas or is it simply an accidental coincidence ? At all events, Semper's views and those of the English revivalists were the same, and the outcome of the latter's initiative has proved the soundness of Semper's ideas; for never has a more gigantic step in art progress been made than that of England since 1852.

For the education of artists and especially of architects, Semper is not a partisan of schools. There again, curiously enough, his ideal is realized in England at the present day and in England only. Semper wishes the future artist, before taking up with any speciality, to be trained in literature, mathematics and sciences. Thus qualified the student should be thrown at once into the practice of his art, receiving as well facilities for getting any information he may want. His acquirements will then be self-made

discoveries sanctioned by personal reflection. To be fruitful, art-knowledge must be the result of experience rather than of teaching.

Before beginning the subject proper of his book, Semper gives us his theory of beauty so that his readers should know the exact meaning he attaches to the terms he employs.

Man, he says, is born intellectual, that is with an instinctive wish to comprehend the world in which he lives, with a dissatisfaction at things as they are and a desire for improvement and perfection. The impossibility of satisfying these, his higher instincts, gives him pain. Still the satisfaction of those instincts is as necessary to the preservation of his mind, as the satisfaction of hunger is to that of his body.

From this aspiration to improvement and perfection three human manifestations have sprung: Science, by which we endeavour to discover the essence of things, an enquiry which fills us with hope and affords thereby temporary relief to our thirsting souls, but which always ends by being baffled; Religion, by which we image forth a state of perfection beyond the tomb and endure the present as of no account; Art, by which we create for ourselves a small world, a microcosm, perfect within its limits, in the contemplation of which we forget reality.

Man, in the very first works of his hands, followed some of the laws of nature, Eurhythmus, for instance, suggested by the regular recurrence of the days, seasons and tides.

On the general laws of nature are founded architecture and music, which are therefore cosmic not imitative arts. The imitative arts, even the feeling for the beauties of nature, are dependent on these cosmic arts; man took pleasure in rhythmic dances, in necklaces of beads, long before he saw any beauty in the open flowers; it is the very training produced by those primeval arts which allows us to admire nature. The charm of a landscape for a spectator depends on his capacity to appreciate it. For instance, a friend of mine had stopped his carriage to gaze at a magnificent sunset on Mont Blanc as seen from Geneva; some country labourers were passing by and stopped to look also; after a while one of them went up to my friend and asked him what he was looking at, as they could not make it out. The fact is, the man of culture, in looking at nature, conjures up a scene by which he completes what he sees into a harmonious whole. This is also exactly what the painter, the sculptor and the dramatist do for us, and, as we gaze at their creations, we forget for a moment our own selves and are lifted up above the imperfections of existence.

In nature and in art, an object stands out clearly before our vision when it has individual characteristics, but when the object is scarcely distinguishable from its surroundings our impression of it is blurred.

In the lowest forms of creation, crystals for instance, the individuals are entirely disconnected from the rest of the universe; they have nothing in their shape which relates to their surroundings. The centre of a crystal is a centre of attraction to which all its parts converge, and around which they are distributed at regular intervals, thus illustrating the law of Eurhythmus, which we obey whenever we want to cut off an object from its

surroundings by a frame and thereby heighten its importance—be the object framed the neck of a fine lady, or the rude mystic symbol of a Druid's temple.

An eurhythmical object resting on one of its sides forms in relation to its basis a symmetrical figure. Plants give us the notion of proportion as a result of the conflict between their vital power and the attraction of the earth. In animals we find another characteristic of individuals, namely direction, a result of the conflict between their will and the resistance of either inertia or the medium in which they move.

Eurhythmus, Symmetry, Proportion, Direction, such are the fundamental elements of form. In nature, moreover, we find the law of Subordination. Artists, like nature, are wont to indicate the purpose of their works by subordinating Symmetry to Proportion and Direction, or vice versâ. For instance, Symmetry is the special characteristic of frames, windows, doors, altar-pieces; Proportion predominates in towers; and Direction in things that have a Bias of the Will, such as a ship, a cathedral, on the one hand, and the personal ornaments of the hunter and the warrior (the flag, the plumed helmet), on the other. Semper goes lengthily into a very minute analysis of these questions, but I think what I have said will be sufficient to understand any further reference he may make on these abstract elements of form [Illustn. ix].

Technical Origin of the most important features of Architecture.—Many authors in searching for the origins of architecture have started with the idea that the simplest forms are the oldest; but, just as it has been found in the comparative study of languages, that our poorer dialects are the descendants of much richer stocks, such as Sanscrit, so it is with Architecture; what seems to us primitive is only derived many times over.

The world is too old to allow us to follow the history of human culture up to its source; the patriarchal organization of the founders of Israel was but a piece broken off the stem of an absolute monarchy. Their social state was not a bit more primitive than that of the wandering Arabs who erect their tents on the ruins of Babylon, the mighty city of their forefathers.

In the research into the origins of architectural forms, chronology is no guide; a primitive form of art may endure in one country centuries after it has entirely disappeared from another. The Egyptian basso-relievos, which are older than those found in the Assyrian palaces, yet belong to a later development of art; their apparent stiffness and primitive simplicity is designed in accordance with the religious principles of the Egyptian priests, and they can be proved to be derived from richer, freer and yet older forms of art.

But this is certain: firstly, wherever we find traces of monumental buildings, to whatever time or country they may belong, we observe certain features which, however modified, are ever essentially the same; we may conclude, therefore, that these features are older than all social organisms. Secondly, the primitive features were borrowed from the processes of the technical arts or trades. They obtained very soon a symbolical meaning, religious or ornamental; but, nevertheless, their original purpose has never been entirely forgotten, and still influences the architectural forms of our day.

To the study of the formation of these types we must turn our attention, if we want to catch architecture at its source.

Every work of man is the result of two primary conditions: firstly, the purpose he wishes to serve; secondly, the stuff or material, and also the instruments and technical processes he employs.

As the purpose of a particular work remains the same in all times, being based on the wants of man which change not, the study of the influence of Purpose on the form of objects leads to considerations on their general shape.

On the other hand, the materials and the technical processes we use, change in the course of time. In discussing how they modify our works we discover what we call Style, that is to say, rules special to each case. A band, for instance, is a strip of stuff which is wound round something to bind it, this is the general character of all bands; but, how a band is to be fashioned according as it is made of flax, leather or metal, is a question of Style.

There is a third element which enters into the formation of the works of man, an element which varies infinitely and therefore affects Style; that element is the degree of culture, particularly the religious, philosophical and political theories of the men for whom or by whom different works and objects are made. This is a big question that Semper reserved for the second part of his work on Style, a part which has unfortunately not been published. I do not possess sufficient notes of Semper's lectures on that subject to be able to give you a full account of his teaching; but I believe we need not despair of possessing Semper's work itself as his sons must have his manuscript and are likely to publish it.

Classification of the technical arts or trades.—According to their properties, the raw materials used by man can be divided into four categories. They are:—

(*a*) Supple and tough, offering great resistance to tension.

(*b*) Soft, plastic, capable, after moulding, of being hardened into a permanent form.

(*c*) To be found in long pieces of great elasticity and resistance to flexion.

(*d*) Tough masses that resist both pressure and breakage, which are shaped by cutting away parts thereof or carving.

According to this division of the materials which they principally employ, the trades can be divided in the following way:—(1) Textile arts; (2) Ceramic arts; (3) Tectonic (carpentry, joinery, &c.); (4) Stereotomy (masonry, carving, &c.). In reality, the limits of each trade are not sharply defined; each, it is true, works a material which is specially adapted to certain purposes; but, on the other hand, there are all kinds of exchanges, borrowings, transformations, by which the product which is the outcome of one material is imitated in products which are the outcome of other materials. For instance, ceramic art has for its main object the producing of vases in clay; but vases are also made of other substances, such as stone, metal, wood, even textile materials (viz., wicker work). In studying the art questions relative to the ceramic trades we cannot limit ourselves to works in clay, but must treat as a part of ceramic art all those products which are similar in purpose to works in clay.

Again, there are many products in clay which do not belong originally to clay work, but are imitations of the produce of other trades; such are bricks and roof tiles, imitations of stonework, and such are also ornamental tiles to clothe floors and walls, imitations of carpets and tapestry. The artistic treatment of such subsidiary products is influenced rather by the works copied than by the materials with which the latter are copied. We must, therefore, study these subsidiary products of clay as part of the group of their original models.

According to the same broad point of view, the word Carpentry, as Semper uses it, is applicable not only to works in wood, but to some structures in stone, as in Greek architecture, and to some systems of metal construction. Stereotomy is not limited to masonry, but comprises carving in any hard material, and even modelling when it is an imitation of carved work. As for the Textile arts, they are connected (as mentioned above) with Ceramic art in tile pavements, with Carpentry in lattices and in wainscoting, and, in fact, with all parts of architecture by the principle of clothing structural parts, a principle which is the primary idea of all decoration. Semper succeeds in showing that the clothing principle governed the arts, and especially architecture, up to the Gothic period, when, according to him, the building principles of antiquity were abandoned. Unlike the ancients, Gothic architects emphasized the constructional parts of a building by making it wear, as Semper puts it, its ribs outside its skin.

Amongst the materials we use there is one which unites in itself all the properties of the others; this is metal. It is tougher than flax, it is plastic when heated and hardens when cool, it has in a higher degree all the advantages of wood, and just as well, if not better, than stone; it may be fashioned by carving. For this reason, the technical processes applicable to it are numerous. It can be embossed when cold, wrought when hot; it can be stamped, coined, soldered, welded, riveted, enamelled, gilt. Every one of these processes for working metal has given rise to special ornaments and has greatly influenced all arts, and architecture in particular; Semper is therefore justified in dealing specially with this subject, which he does at the end of his book.

(1) *Textile arts.*—Semper thinks Textile arts are anterior to all other arts, because textile work, borrowing nothing itself, lends its ornaments to the products of nearly every other trade.

Tissues are used either as threads, strings, bands or as surfaces. In the first case they serve either to bind together elementary parts in a bundle or to file a number of objects in rhythmical rows. Both these characteristic textile products have been copied in architecture. The one is represented by the astragal and the torus, the other by the ornamentation of cimas, mouldings, bands, in imitation of the crowns and necklaces of flowers which played such an important part in the life of the ancients [see *Athenæus Deinosoph.* xv., 16, in footnote,[21] and the sketch of Egyptian basso-relievo, Illustn. x, 27.]

[21] *Athenae Deipnosophistae*, Liber xv., 16. 'Εστεφανοῦντο δὲ καὶ τὸ μέτωπον, ὡς ὁ καλὸς 'Ανακρέων ἔφη: "'Επὶ δ' ὀφρύσι σελίνων στεφανίσκους θέμενοι, θάλειαν ἑορτὴν ἀγάγωμεν Διονύσῳ."——'Εστεφανοῦντο δὲ κἂι τὰ στὴθη καὶ ἐμυροῦν ταῦτα, ἐπεὶ αὐτόθι ἡ καρδία. ἐκάλουν δὲ καὶ οἷς περιεδεοντο τὸν τράχηλον στεφάνους ὑποθυμιάδας. Καὶ Ανακρέων ἔφη. Πλεκτὰς δ' ὑποθυμιάδας περὶ στήθεσι λωτίνας ἔθεντο. Αριστοθέλης δ' έν τῳ Συμποσίῳ φησὶν, ὅτι" Οὐδὲν κολοβὸν προσφέρομεν πρὸς, τοὺς θεοὺς, ἀλλὰ

There are also flat woven bands which, spanned at regular intervals across a space as a support to canvas fields, form a prototype of the Greek coffered ceiling. The band is also used as a free, fluttering ornament, such as flags and ribbons, which serve to emphasize the movements of the wearer. Light ribbons add grace to the dancer, heavy hangings give dignity to the priest; they appear in architecture under the form of acrotères, either on the gables of the temple or the prow and stern of a ship, where a certain determined direction is to be suggested.

When textile products are used in the form of surfaces, they serve the purposes of covering, of protecting, of enclosing, and as such are the oldest representatives of these abstract ideas. From them language borrows its words, religion its symbols, and architecture its ornamentation. They are, says Semper, the primitive models of our floors, ceilings and walls; and starting from this point of view he devotes many chapters to the treatment of these architectural elements.

However interesting to architects the opinions of Semper may be, I must limit myself to one or two of his observations, just to give you an idea of their substance: Suppose two square rooms, the one being a museum hung round with pictures, the other being formed by the intersection of two galleries, and therefore open on each of the four sides by wide archways. Which is the proper direction to give in each case to the floral ornaments of the pavement? In the museum, the spectator stands in the middle of the room, and, therefore, the floral ornamentation should rest on the central field and develop towards the walls. In the second case, the square hall is only a place of passage, the most artistic treatment of the same is to place in its centre a grand marble vase which can be seen equally well from any of the galleries which meet there. The floral ornaments of the pavement should start from the outer border and grow towards the centre of the hall, thus will the spectator see the flowers upright on entering and the room be characterised as a passage.

In any room, the most brilliant effect of colour and decoration should be reserved for the ceiling. There are many reasons for this: firstly, the surface of the ceiling is not disturbed by any utilitarian purpose such as are the walls; then a painting on the ceiling is never too close for proper inspection, hypercritics cannot pry into details, and the impression on the spectator is as vivid as it is necessarily cursory. Pictures on walls, on the contrary, are blurred by the chromatic spectrum of complementary colours which we perceive whenever we fix any given colour too long.

Speaking of colours, he says there are only two systems of decoration: the one rests on the equiponderation of colours, by which a richly homogeneous yet quiet effect is produced, an effect noticeable in all Oriental decoration; the other is the Greek principle of subordination or contrast, wherein colours are toned so as to bring out a culminating effect or climax.

The special process which has had perhaps the greatest influence on the primeval

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τέλειά καὶ ὃλα. Τὸ δὲ πλῆρες, τέλειόν εστι. Τὸ δὲ στέΦειν, πληρωσίν τινα σημαίνει. The definition of Aristotle is therefore: Wreathing symbolizes a certain perfection. Hence the reason for wreathing the top and bottom of objects to complete them.—L. H.

development of art is that of Sewing. Semper believes that sewing is connected with the first idea of necessity, in fact, in German *Noth* and *Nath* and in English *Knit* are nearly the same word as in Greek νεω and ἀνάγκη; in Sanscrit we find also *Nah* and *Natha.* The ornamental seam is the principal decoration used by Red Indians, who have learnt therein the very essence of technical art, which consists in turning into an ornament a constructional feature which otherwise would be an ugly blemish; in other words, they learn to make a virtue of necessity. The process of sewing teaches us an important principle of design, viz., never to place pictorial subjects, be they painting or sculpture, in the parts which have a constructional purpose, but reserve them for neutral fields, such as pediments and metopes. In sewing this principle is self-evident, for the seam is utterly inappropriate for receiving pictorial embroidery; it is limited, both artistically and technically, to characterising the connection of two pieces of stuff.

The knowledge of the use of knots preceded probably that of sewing. Curiously enough the *knot* is to be found in all countries as a religious symbol. In Illustn. xiii are examples of knots found in Greece, Ireland, Germany, Scandinavia and Egypt. The button is also a kind of seam, and may be the prototype of rivets and rosettes, as in the example of an Assyrian carpet cut upon a stone slab [Illustn. xii, 46].

Style of Textile Products.—This is, in other words, the art to accommodate the treatment of an object to the requirements of the material it is made of.

Semper includes in the materials of textile art man's own skin, the skins of beasts, caoutchouc, lackerwork, papier-maché, as well as the proper textile tissues, such as flax, cotton, wool and silk. He goes very fully into the history of the use and manufacture of every one of these materials, to which he devotes 115 pages. Tattooing of the skin, Semper thinks, is a practice derived from a higher state of civilization. He has recognized, in the ornaments savages use in tattooing, features which belong to metal work. To the wearing of the skins of beasts, especially as ornaments for warriors and priests, we can trace the curious heads of Egyptian gods as well as the masks and other animal attributes used in antique architecture and furniture.

A comparison of the Oriental leather wares with our own is an excellent study to initiate us into the refinements of good style, and thereby is indirectly useful to the study of architecture.

Lackerwork is a process very similar to that which the Egyptians, the Assyrians and the Greeks used in their ornamentation, especially of metal-work, and is for this reason fully investigated by Semper. Flax, or linen, is characterized by its coolness, glossy surface and toughness; the special advantages of this material should be emphasized, not disguised; when ornamented, it should be either left white or lightly tinted with cold colours such as indigo. To the use of linen, Semper attributes the chromatic scale of Egyptian ornamentation. Cotton has no particular character or style appropriate to it, for by its properties it resembles both flax and wool, and serves mostly to imitate these more expensive stuffs. Wool is particularly adapted to warm colours, it was one of the principal manufactures of the Assyrians, and has much influenced the character of their wall decorations; it imparts to the Greek dress and to

the Roman toga their sculpturesque folds. Silk, originally from China, when introduced into Greece was unravelled and rewoven into a light transparent stuff at Cos, as may be proved by passages in the writings of Aristotle, Pliny and Lucan.[22] The Greeks did for silk what they did with all Oriental products and arts; they used it as a raw material to work out their own creations; for in Greek work, not the stuff but the spirit is new.

Silk, in its characteristic form, was unpleasant to the ancients and was not generally adopted until the Byzantine period, when the Greeks had themselves become Orientals. Silk is the key to the art of the middle ages, just as the former stuffs are to that of antiquity. To the introduction of silk from Babylon we owe the mystic beasts or monsters so often found in Byzantine ornamentation; gold brocade, in which a brilliant stuff serves as a background to a still more brilliant pattern; Damask ornamentation, based on graduations of gloss, reminding us of Moorish architecture; satin and velvet, the special delight of the Renaissance, as shown in the paintings of Titian, Paul Veronese, and Holbein.

Such is roughly the connection between these materials and the different epochs of the history of art; but apart from the raw material, we must consider manufactured wares as a result of technical processes used to produce them. We shall find therein many an element which has been copied in architecture; such are twisted cords, plaited bands, ornamental knots, surfaces bedizened with network, lace tracery, matwork, which is the prototype of Assyrian, Egyptian and Moorish glazed bricks, woven stuffs, and lastly embroidery, to which Art is especially indebted.

There are two kinds of embroidery, the one is produced by the satin stitch (*Opus plumarium*), in which the coloured thread is laid over the surface of the ground in parallel rows so as to produce a coloured ornament in basso-relievo. This kind of embroidery is, according to Semper, the precursor of all the basso and alto relievos of antiquity. These relievos are embroidery produced in durable material, stucco, metal, and stone; we shall not be surprised, therefore, to find them coloured, and that the two ideas of form and colour were not separated till very late. The satin-stitch is nearly as free as the paint brush, and therefore is particularly well adapted to pictorial art; the other style of embroidery is done on canvas with a cross-stitch (*Opus Phrygionum*) and has to follow the regular pattern of the canvas back; it is, therefore, of much more limited application than the former; was used at a very early period by the Egyptians, and may have been the prototype of their wall decorations, for, curiously enough, the Egyptians covered their walls with a network of squares to prepare them for painting.

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[22] Aristot. *H. Nat.* v., 19. *'Εκ δὲ τούτου τοῦ Ζῴου καὶ τὰ βομβύκια ἀναλύουσι τῶν γυναικῶν τινες ἀναπηνιζόμεναι, κ'άπειτα ὑφαὶνουσιν· Πρώτη δὲ λέγεται ὑφῆναι ἐν Κῷ Παμφίλη λατώου θυγάτης.*

Pliny, *H. N.*, VI., 17. Primi sunt hominum qui noscantur *Seres*, lanicio silvarum nobiles perfusam aqua depectentes frondium canitiem: unde geminus feminis nostris labor redordiendi fila rursum texendi. Tam multiplici opere, tam longinquo orbe petitur, ut in publico matrona transluceat.

Lucan, *Phars.*, X., 140. Divitias Cleopatra gerit, cultuque laborat: Candida Sidonio perlucent pectora filo, quod Nilotis acus percussum pectine Serum solvit, et extenso laxavit stamina velo.—L. H.

The textile products are the leaders which have fixed the chromatic scale of coloured decoration; of special importance is the process of dyeing, which is much older than painting. The ancients did not use, perhaps did not know, pure abstract colours, and to that fact is due much of the harmony of their work. When they speak of colours, they always qualify them by the name of a natural phenomenon, as, for instance, apple green, sea green, &c. The colours used were from two distinct origins; some were extracted from the products of the sea, and were called purples. If you examine the colours of a collection of shells you have the whole gamut of antique purple dies. The other colours, which Pliny calls the terrestrial, are due to the vegetable world. An idea may be obtained of the delight the ancients took in colour by consulting Ovid, *De Arte Amandi,* 3. 165, where he describes the Roman Rotten Row.

Semper believes that clothing was probably not originally intended to protect man's body, but to adorn his person. There is a connection between the dress of a people and its architecture, for both are characteristic products of its civilization. Democritus of Ephesus wrote a book on the temple of his native town, and began his preface by describing the luxury in dress of his fellow citizens; if we had chanced to possess the whole work, of which this is a fragment, we should have long ago been enlightened on the polychromy of ancient architecture, for it is evident that Democritus meant to draw a comparison between the luxury, the brilliancy of the dresses of the Ephesians and the architecture of their great temple. It is hardly possible to believe that men who delighted in such colours for their clothing should be satisfied with white walls for their buildings.

The connection between costume and architecture is of two kinds; on the one hand, architecture borrows some of its ornaments from dress; on the other hand, it bears with dress the impress of analogous influences, such as the taste, character and civilization of a people. The flowing dress of the Greeks, the simplest and yet most beautiful form of clothing, was adopted as the national costume of the Greek race only in the Periclean Age when Hellenic civilization was at its zenith.

Clothing belongs to one of three types, the Apron, the Shirt, and the Cloak.

The Apron is a piece of stuff tied round the waist, and as such it comprises women's petticoats and men's trousers, as well as the apron proper. It was the sacred dress of the Egyptians, who, biassed by their theological views, considered it as the representative of primitive clothing.

The Shirt, though not unknown to the Egyptians, is specially the garment of Assyria, where it attained its full development; the Assyrian dress consists of many shirts placed one over the other, differing in length, material and colour. It is extraordinary how permanent customs are in the East. In September 1883, a Swiss traveller, Herr Moser, was presented to the Emir of Bokhara, and he says that full dress consists of wearing kaftan over kaftan; the greater number of kaftans you wear the more you honour your host; to fulfil this requirement of Oriental etiquette with his European clothes, he adopted the device of wearing all his waistcoats one over another.

As for the Cloak, the Egyptians reduce it to a kalasyris, an apron worn over the

shirt, and the Assyrians to a girdle made out of shawls, both following therein their natural genius, so different from the free spirit of Greece.

The Clothing principle in Architecture.—Greek art is not of native growth but is a development and combination of the Assyrian and Egyptian arts. In both these older countries decoration consisted in clothing the structures either by covering their surface or by incrustation; in Greece the clothing of a building is neither material as in Assyria, nor imitative as in Egypt, where the bearing pillar seems independent of the lotus stems bound round it as an ornament, but in Greece the clothing is reduced to an abstraction, viz., the colour which covers the building inside and out. To this Greek refinement of the idea of clothing must be attributed the absence of apparent joints in the stone walls of the Cella, by which the construction is disguised as by a thin veil, so that clothing and construction are one, whereas with the barbarians they were only mechanically not organically united. Nevertheless, with the Greeks as with the Assyrians and Egyptians the essence of the decoration is the masking of reality. All temporary festal structures are ornamented by clothing, such as garlands of foliage, bunting, tapestry, flags; and these short-lived erections served as models for the permanent monuments which replaced them. Solomon's temple was a copy of the tabernacle, in which layers of skins were replaced by gilt facings of cedar; the stone theatres of Rome succeeded to the wooden ones; the triumphal arches to the rough scaffoldings of poles covered with painted representations of the Roman victories and of the spoils of the vanquished. It is in these temporary decorations that we discover art in its very beginnings. Art's main characteristics have endured in its later developments, and clothing is still now the essence of all arts, of poetry, sculpture and painting.

To follow out Semper's argument on this point would carry us too far, so we must pass on to the study of the transformations in the clothing principle brought about by the change of materials and technical improvements. For instance, the wooden idol was first covered with festal clothes; secondly, the clothes were replaced by metal beaten on to its surface; thirdly, the wooden kernel of the idol was left out and the metal coating alone remained, such was the construction of the oldest colossal statues of antiquity, as shown by Pausanias, in his Description of the Statue of Zeus Hypathos[23] on the Castle of Sparta; fourthly, casting was introduced in its early stage as a thin coating of bronze laid on a kernel of iron; then, fifthly, hollow casting was invented. Such are briefly the principal stages in the historical development of statuary, and as marble and terra-cotta statues were perhaps later developments of statuary, we shall find that the history of architecture runs very much on the same lines, although on account of the variety of building materials architecture is a vaster subject of enquiry.

In the Exhibition of 1851 there was a model of a New Zealand village, wherein

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[23] Paus. 3, 17. Τῆς χαλκιοίκου δὲ ἐν δεξιᾷ Διὸς ἄγαλμα Ὑπάθου πεποίηται παλαιότατον πάντων ὁπόσα εστὶ χαλκοῦ· δι' ὅλου γὰς ουκ ἔστιν εἰργασμένον, ἐληλαμένου δὲ ἰδία τῶν μερῶν καθ' ἀυτὸ ἑκάστου συνήρμοστάι τε πρὸς ἄλληλα κὰι ἥλοι συνέχουσιν ἀυτὰ μὴ διαλυθῆναι. Κλέαρκον ἄνδρα Ρηγῖνον τὸ ἄγαλμα ποιησαι λέγουσιν, ὃν Διποίνου και Σκυλλιδος, οἱ δὲ ἀυτοῦ Δαιδάλου φασὶν ἔιναι μαθητήν.—L. H.

Semper was struck to find an instance of the art of plaiting applied to the making of the walls for the defence of villages and houses; a fact which strengthened his conviction in the textile origin of walls. The tops of the piles which supported the woven walls were decorated with carved heads, which probably took the place of the heads of their foes; on the other hand, the exhibits of New Zealand did not contain evidence that the art of pottery was highly developed.

The importance of China for the study of the origins of Art is great. Primitive architecture, exemplified in the ruins of Asia, Egypt and Magna Græcia, may be now studied in Chinese architecture, which has remained unchanged from the most remote antiquity.

Chinese construction is made up of parts not organically connected; posts carry the roof andceiling, the walls are apparently nothing but screens. The Polynesian plaited fence is here developed into a rich ornamental system, namely, the lattice-work which is always found in a Chinese house; the floors are covered with mats, and drapery completes the building with partitions and curtains; all the surfaces of the house are lacquered, gilt and glazed; only the walls of terraces and foundations show their stone-work bare, a feature we shall find common to all ancient architecture. Could we but see Pompeii as it was 1800 years ago, it would strike us in many respects as very Chinese!

The opinion that India is the cradle of mankind does not agree with the tale told by its architectural remains, which points to a mixed style derived from various sources. When we consult the oldest written documents, such as the Ramajana and the Mahabharata we find that even in those early times, Indian art was most complicated and rich in forms; wood, brick, stone, metal and stucco were already all in use, and each of these materials had brought its contingent of special features; but the one which seems to have had the greatest influence on Indian architecture is stucco, for the overloaded ornamentation of Indian monuments is nothing but stucco work imitated in stone. We read in the Mahavansi a description of the Buddhist convent Lohaprasada in Ceylon, built about 200 years before Christ. It was a brick building supported on stone columns 12 feet high; all parts of the structure were covered with the most precious materials and the richest ornamentation; the columns were decorated with sculptures of lions, tigers and other beasts, as well as gods. Such is the description. We may see the ruins of this building; most of the 1600 columns are still standing; they are roughly hewn blocks of gneis, and one can perceive that they were all covered with a thick layer of stucco, by which these ill-fashioned piers obtained the rich sculpturesque ornamentation the old records speak of. Semper is induced by this discovery to venture on the very bold hypothesis that the dolmens and Druid circles of Stonehenge and Brittany were but the kernel of stucco structures. At all events, the use of stucco for basso-relievos is proved to have preceded stone carving in India. When stone relievos superseded the older work, they were covered with a thin coating of painted stucco, so that in outward appearance nothing was changed, only the kernel was of more durable material. In the same way, modelling in clay is probably derived from stucco by serving as a kernel to the same; so are mosaics, painting and metal plating, parts of the clothing system which have succeeded to stucco.

Mesopotamia was the land of embroidery, tapestry, carpets, which, by being exported, carried the native arts of Mesopotamia far away to all known countries, but specially to Greece, where the pictorial subjects and monstrous creatures which adorned these stuffs were the origin of many a Greek fable and peopled the Hellenic Olympus; symbols of mystic meaning, such as the volutes of the tree of life, became architectural features. Moreover, borders, seams, fringes, buttons, knots and other elements of textile work became common types used in decoration. Such was the influence of the arts of Mesopotamia on ancient architecture.

Digression on the Upholstery of the Ancients.—The customs of comparatively recent times when they are the outcome of old traditions may be advantageously consulted for interpreting the too scarce remains of remote antiquity. This reason has induced Semper to prefix to the study of the Mesopotamian realms a digression on the upholstery of the ancients. In the interior of ancient buildings the joiner has very little to do, but the vestiarius or upholsterer nearly everything. The art of the vestiarius comprised three objects: firstly, the permanent furniture and upholstery of a house; secondly, the decoration of buildings on festive occasions; thirdly, the erection of temporary structures, such as tents.

The atria of Roman houses were originally large covered spaces without any partition-walls whatever. Privacy was obtained, just as in China, by movable divisions such as screens and curtains, allowing the space to be adapted to every purpose, viz., the public receptions, the domestic labour of the wife and her slaves, the family bedroom. Later on, partition-walls were built inside the atrium to divide the cubicula and other rooms destined to special purposes, but the primitive custom was still perpetuated in the wall decorations and the taste for upholstery generally. The front and back openings of the tabularium were closed by curtains, and so were all the doorways inside a house, for there are nowhere any traces of interior doors. The spaces between the columns of public and private buildings were filled by drapery, as a preservative against either the weather or the sunshine; the richest stuffs were used for that purpose, either attached to the columns by cords or supported by trestles, *scabilla* (hence *échafaud, scaffold*). Between the columns were also placed paintings, basso-relievos and statues; this explains the immense quantity of objects of art we read of in the descriptions of ancient monuments. We often find allusions to this custom in ancient authors. Aristophanes (*Wasps,* 1215) advises a man of bad manners to admire the ceiling and the curtains of the aula; Propertius (ii., 23, 46)[24] mentions the splendid tapestry of the portico of Pompey; Martial (xiv., 150)[25] speaks with high praise of tapestry manufactured

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[24] Ἀριστόφ. Σφῆκες Βδεδυκλέων: τα γόνατ' ἔκτεινε, κὰι γυμναστικῶς ὑγρὸν χύτλασον σεαυτὸν ἐν τοις στρώμασιν. ἔπειτα ἐπάινεσόν τι τῶν χαλκωμάτων, ὀροφὴν θεάσαι, κρεκάδι αὐλῆς θαυμάσον.

Propertii II. Eleg., 23, v. 45. Appia cur toties te via ducit anum? Scilicet umbrosis sordet Pompeia columnis Porticus auleis nobilis Attalicis.—L. H.

[25] Martial (Lib. XIV., 150).

Haec tibi Memphitis tellus dat munera: *victa est*
Pectine Niliaco jam Babylonis acus;

that is, Babylonian embroidery is surpassed by Egyptian weaving.—L. H.

in Egypt and sent as a present to one of his Roman friends; and in the Book of Esther we find the description of the intercolumnar drapery belonging to the portico of the king's palace.

Curtains were used also as screens to sacred objects such as the Sanctuarium of Solomon's temple, and to veil the statues of the gods which were exposed to view only on certain occasions. Comprised in vertical drapery was the curtain of the Roman theatre, which did not drop down as with us, but rose from the floor and formed a screen sufficiently high to hide the actors, only the top part of the scene remaining always in view, which explains the words: "Scabilla concrepant, auleum tollitur" in Cic. pro Cælio 27.[26] The origin of this arrangement is perhaps to be found in the practice of having screens of drapery held up by slaves to protect the king from the gaze of the populace, an Oriental tradition still in force, as shown in *The Illustrated News,* Sept. 6, 1856; and referred to by Virgil, *Georg.* III. 25; Ovid, *Metam.* III. 111.[27]

As a protection against the sun's rays, velaria were suspended over the atria of the houses and under the unroofed compluvia of temples; such was probably the embroidered peplos of Minerva in the Parthenon. The fashion still exists in Cairo.

We have already mentioned the temporary decorations of Roman triumphal pomps as precursors of the permanent monuments erected later on in memory of the event. Semper goes fully into the subject: the decoration of the festal road with draperies, velaria, masts with streamers, and the fixing of immense pictures on the walls of the buildings alongside the triumphal course; the *tensæ,* huge machines on wheels covered with the spoils of the vanquished and with pictures on canvas representing battles, plans of cities and maps, the vanquished and the victors. He notes how much these paintings remind one of the alabaster basso-relievos of Nineveh, and also of the embroideries and paintings of the middle ages; their purpose was illustration of events, therein entirely removed in spirit from Greek art, whose sole object was beauty. The column of Trajan is such a tensa carried out in marble.

Later on the passion for plundering the conquered countries of all their art treasures brought about a new style of decoration. The works of art were not stuck side by side as in a museum, but arranged as parts of a general design; this was the model from which the Renaissance borrowed some of its best work.

The oldest piece of upholstery of which we have a full description is the tabernacle of Moses; a very good illustration of the clothing principle it is, not only by its three layers of stuff to form the tent, but by its posts, some plated with gold, others with silver. We have also descriptions of the tents of Alexander, and of Ptolomæus Philadelphus. In the latter the columns were clothed with palms and other plants, an art tradition the Church of Rome still applies on fête days to the columns of its basilicas. When we

[26] (Cic. pro Coel.) Semper translates "scabilla concrepant" by "the trestles rattle," the ordinary translation: "there is a scuffling with the stools," is less likely.—L. H.

[27] Virg., *Georg.* III. 25, utque Purpurea intexti tollant aulæa Britanni, "and inwoven Britons support "the purple curtains." Ovid, *Metam.* III. 111, Sic, ubi tolluntur festis aulæa theatris, Surgere signa solent, primumque ostendere vultum Cætera paulatim.—L. H.

smile at such clothing of marble columns with precious stuffs, we little think that the column itself is but the clothing of a post. Hull over hull, such is Semper's definition of the progress of art. Not only was wood clothed with gold beaten over its surface, but the gold itself was coated over with a decoration of wax colours. Josephus (Book 17) mentions that when, two years after Christ, the Stoa in the fore-court of the temple was damaged by fire, the woodwork and its gold casing which was covered with wax was destroyed by the flames. To such a kind of enamelling of the surface Semper ascribes the good preservation of the metal work of the Egyptians even in our northern museums.

To the upholsterer was also committed the decoration of the funeral piles, of which that of Sardanapalus is a magnificent example (*Athen.*, XII. 38). They were huge structures; the one erected by Alexander to his friend Hephæstion was 600 feet square, 225 feet high, and consisted of 5 storeys of wood on a basis of brickwork; every storey was decorated with draperies, paintings and sculptures; the cost of the whole structure amounted to six hundred thousand pounds. A general idea of these pyres can be got from the representation of them on consecration medals [Illustn. XV, 62].

Semper has seen St. Peter's at Rome draped for the coronation of the Pope, probably according to the traditions of antiquity, just like the Pagan temples of old. He was struck to find that the drapery magnified the apparent size of the building: then only do you perceive the immense dimensions of the fane. He concludes that drapery is an indispensable finish to classic architecture, for its proportions are based not as in Gothic buildings on a fixed measure, man's foot, but on a variable one, the diameter of a column. In classic work, to have an approximate idea of the size of a building, we require therefore an intermediate object of known dimensions, as a point of comparison between ourselves and the building. The fact that classic architecture needs the help of upholstery, Semper reckons as a great point in its favour, for, thanks to that desideratum, the majesty of Roman churches may be artificially heightened when circumstances require it.

From what has been said on the upholstery of the ancients, we gather a living coloured picture very different from the notions which prevailed before Semper's time. This more complete and more correct view of our subject will be of great assistance to us in pursuing our investigations, the next of which will be the art of Chaldæa.

The civilization of Mesopotamia took its rise near the Persian gulf, and then followed the banks of the Tigris and the Euphrates. The oldest buildings of that region are probably those of Chaldæa, the remains of which, insufficient for us to reconstitute the originals, yet suffice to show the early development of the clothing principle. Firstly, in the ruins of Wurka, we see a wall covered with $2\frac{1}{2}$ inches of stucco, and other walls are encased with a mosaic formed of terra-cotta nails 6 inches long, $\frac{3}{4}$ inch thick, driven into the surface of the clay, which it protects as well as decorates with carpet patterns. The walls, where the surface is denuded, show layers of reeds projecting like those still used in China for the retaining of the stucco surface. Some parts of Wurka are filled with terra-cotta coffins heaped up 20 feet deep one over the other, evidently brought there from all parts of the country to lie in consecrated ground. These coffins are an

imitation in green glazed earthenware of the winding-sheets of the corpses, a clear example of a textile product reproduced in durable material.

Thanks to the clothing principle, as manifested in the alabaster dados which decorate the walls of the interior chambers of Nineveh, we have obtained a clearer idea of the Assyrian than of the Chaldæan architecture. The outer walls of Nineveh form a rectangle for the protection of the town. At the north-west angle of this enclosure there is a high terrace, half within, half without the wall, forming a kind of bastion; again a smaller and higher terrace rises at the outer angle of the first bastion and forms the keep on which were built the temple of the god, the palaces and sepulchre of the king. What still remains of all this, is part of the terraces which are formed of a network of subterranean passages crossing one another; a system of construction we shall find in all ancient terraces and substructions at Baalbeck, Persepolis, under the Capitoline temple of Jupiter and inside the Cyclopean walls of Tiryns and Nauplia. The Romans called these passages "favissæ," the Greeks "syringes" (pipes); they were no doubt the origin of the fabulous labyrinths mentioned in the mythology of nearly all the people living around the Mediterranean.

This hollow cellular construction of terraces, is but the application on a large scale of the principle of construction exemplified in corrugated or tubular metal-work, a principle which is the outcome of the clothing of woodwork with laminated metal. All the representations of furniture, cars or other utensils on Assyrian walls, point clearly to metal either hollow, or casing a wood framing, thus forming a strong contrast to Egyptian metal work, which is solid and made of thin bars [see drawings of Assyrian versus Egyptian cars, Illustn. xv, 68, 71). The metal plating and the hollow-work appear under three forms: firstly, a square framing; secondly, a circular section of kernel with corrugated plating; thirdly, a plating of thin metal pressed out on a lathe like tinware and used only for vertical supports [see Etruscan bedstead, and lower part of Assyrian seat, Illustn. xv, 69, 70].

Specific details of such plated work are: firstly, seams either folded or riveted, or both; secondly, jointing either by telescoping the tubes or by the means of a collar round the joint. Both these technical processes furnish ornamental features to Assyrian work; but to this we must add ornaments taken from religious symbols, as the holy tree, employed with a structural signification; such are the pairs of volutes which decorate the bottom rail of the Assyrian seat, as though they were tied knots; such are also the claws to the foot-stool as a suggestion of its being a movable object, the heads of the frame which support the weight are so made as to give the cross-piece the appearance of the back of an animal.

A very much later example of the evolutions of metal-work out of the casing of wood-work are two bronze doors at Rome; the one from the temple of Remus follows exactly the original wood-panel construction, the other from the Pantheon presents only outwardly the appearance of panel-work, but is really made of one piece of hollow metal. In the door-frame of St. Sophia, we have an example of metal casing such as was probably used by the Assyrians themselves [Illustn. xv, 64, 65, 66, 67].

We have descriptions by Greek authors of Assyrian palaces with gold columns, gold walls and roofs, and we conclude that the buildings on the top of the highest terrace of Nineveh were formed of wood and metal just like the Assyrian furniture, the columns resembling probably the marble columns of Persepolis, which bear very clearly the character of metal-work [Illustn. xvi, 72].

The essential difference between a movable piece of furniture and a building is that the former must be a structure holding together independently of external support, whereas the building relies entirely for its solidity on the earth that supports it; the furniture should therefore be characterized by lightness, the building by the stability of each of its parts independently of their joint action. For this reason a Greek temple is monumental, but a modern iron structure cannot be.

People may doubt the rigour of Semper's deductions; they may doubt that columnar architecture is the outcome of casing wood-work with metal; but the clothing principle has evidently been applied to the construction of the terrace walls of Assyria. These walls are built of sun-dried bricks, which are protected against the weather and other destructive agencies by a coating of hard materials; and on the outer side, as a defence against the enemy, by a facing of free-stone 20 feet high, and above this by glazed bricks. In the interior of the subterranean vaults, the walls are covered either by stucco or glazed tiles or by the well-known alabaster relievos. From a careful examination of the glazed bricks, Semper concludes they were produced in the following way: They were laid together on the floor after being sun-dried, then the whole surface was painted over with enamel colours (this is shown by the joints being in no way studied in designing the decoration and also by the colour having run through the joints as it would if laid on a horizontal surface of jointed tiles). When the colours had dried, the tiles were built up in their proper positions on the wall, thanks to the numbers marked on their backs, and then the colours were burnt-in by making a large fire inside the chamber; this explains why only the surface of these tiles is burnt, whereas the backs have remained raw. If this is so, is it venturing too much to say, that the invention of burning bricks is due to the process of fixing colours by fire, thus showing how much we may be mistaken in our ordinary views of the natural sequence of things?

What the colouring of the alabaster relievos may have been we do not know, but Semper feels quite sure they were neither left naked nor coloured like the Assyrian court of the Crystal Palace; he is inclined to believe that they were gilt and decorated with encaustic wax colours, a process he has already mentioned when treating of Solomon's temple.

In the countries neighbouring Mesopotamia, towns such as the New-Babylon of Nebuchadnezzar, the Median Ecbatana and the Persian Susa show nothing new. As additional testimony in favour of his views on the architecture of these countries, Semper cites the inscription found near Baghdad by Sir Harford Jones and interpreted by Rawlinson and Hinks; the description of Ecbatana by Herodotus, in which we find that it had seven concentric circumvallation walls, rising one above the other, each painted with a different colour, namely, white, black, purple, blue, orange, silver, gold; the description

of the King's palace by Polybius, who says: "Although the construction is of cedar and "cypress wood, yet no part is left naked, but the beams, the wainscoting and columns in "the halls were cased with gold and silver. All the tiles were of silver. In the temple "the columns were covered with gold, the roof-tiles with silver, and the wall-tiles with "silver and gold, of which the worth was 4000 talents, *i.e.* three hundred thousand pounds." Considering that we have found the correctness of the description of these authors proven in the parts which still exist, we can confidently assume their trustworthiness in those parts which have not been preserved, and we are not justified in accusing them of romancing, as it used to be the fashion to do before the discoveries made by Layard and others.

The Lycian monuments which are to be seen in the British Museum would prove that in the time of Cyrus, when Greece was in its infancy, Asia Minor possessed sculptors not inferior to the Greeks after the time of Pheidias, if there were no doubt as to their date. At all events we can be sure of the antiquity of the two lionesses found in the ruins of Xanthos, for we see them represented as standing on the walls of the city in one of the basso-relievos of the triumphal monument built in memory of the taking of the town by the Persians.

The works still existing, which were certainly due to the Phœnicians, are masonry of gigantic stones at Byblos in Cyprus, on the Island Arados, under the Hill of Moriah, and at Baalbeck. These stones served as a facing to terraces of earthwork. As to the buildings themselves, we can gather from the description of the temple of Jerusalem by Josephus (8 cap. 3), that the walls were built of white stone (*ἐκ λεύκου λίθου πεποιημένον*), worked so fine and so closely jointed that nowhere was there a trace of the hammer or the chisel; yet Josephus repeatedly affirms that this stone-work was entirely concealed behind a casing of wood and gold, so that there was no part inside or outside which was not gold; a clear proof that the ancients valued white stone for its *quality* not its colour, for them *white* stone meant *good* stone, just as for us *red* pine means pine of the best quality. We see also by the above, that work intended for sacred purposes was finished with the utmost perfection even where hidden, as a tribute due to the divinity; we are therefore wrong in concluding, as some have done, that the elaborate description of ancient authors proves that the construction of ancient buildings was necessarily seen.

The buildings of Egypt are older than those of Assyria, but yet belong to a later development of civilization. In Assyria, we have a country governed by a military feudalism; in Egypt, a theocratic monarchy has superseded the former military organization. The oldest work still extant belongs to the period of transition between these two states, and we are therefore not surprised to find in the wall-paintings and sculptures of these monuments much of the freedom apparent in Asiatic and Greek art; the subjects are homely, the figures are portrait-like and full of life (see statuette of a scribe in the Louvre). Later, as the power of the priestcraft augments, art becomes more and more respectable, loses all sign of individual life, and merges into a system of writing: the hierogylph.

As to the clothing principle, we find it to be the essential character of the pyramid, both in the purpose of the latter that of a huge inscription table, and in its construction, which consists of layer over layer of stone, not built horizontally but encasing one another

as so many coats over an interior kernel; we find our principle again in the walls of the Egyptian temple, the surface of which entirely devoted to hieroglyphs seems a continuous tapestry spread over a concealed structure. To the idea of clothing belong also such details as the bead at the angle of the walls, a feature still employed by our joiners to hide the joint at the outside angles of wainscoting, and which no doubt fulfilled the same purpose when walls were clothed with stone slabs. Besides all this, we can see that the wall facing, although of granite, both of pyramids and temples was painted and the polished surfaces were covered with a kind of transparent enamel varnish, which has preserved the stone so efficiently that in some buildings we find the interior of the granite attacked by the weather but the outer surface perfectly fresh. It would be worth while making the chemical analysis of this Egyptian varnish for the purpose of applying it to our London buildings.

The Egyptian theocracy aimed at giving to its architecture the character of primitiveness, a kind of pious fraud to impress the faithful with the antiquity of its religious traditions. It is shown by an illustration from Semper's book [Illustn. xv, 60] how in temporary structures the column was but a decorated post; we have seen also how in Assyria this primitive clothing was replaced by a casing of metal, and how the wood kernel was abandoned as useless and the metal casing became the column itself which carried the weight by the rigidity of its surface, and, lastly, we have recognized that the metal column was the prototype of the marble column which superseded it. In Egypt, when we take the oldest columns, those of Beni Hassan for instance [Illustn. xvi, 73], we find they belong in principle to the same family as the Assyrian ones; they also are the interpretation in stone of hollow metal columns, the fluted surface of which carried the entablature. These were the last columns of the military state, but the Egyptian priests abandoned this principle to revive the more ancient idea of the decorated post, especially in such parts of the temple as replaced the temporary covered way for the religious procession. They took great pains to make it evident that the outer-skin of the columns was but a decoration, and had nothing to do with carrying the structure; they obtained that result not only by showing the square post above the lotus capital [Illustn. xvi, 74, 75], but in the latest work, by covering the surface of the column with hieroglyphs as though it were covered by a carpet. Between these two extremes of Egyptian columnar orders, there are the columns with lotus-buds [Illustn. xvi, 76], where the surface strikes one as formed by reeds bound round an inner kernel, but which yet take some part in helping to carry the superincumbent weight.

Before closing our remarks on the Egyptians, we must mention that they were consummate artists in enamelling on metal, and equalled therein any of the work of modern times in champlevé and cloisonné, an art which had an immense influence on Greek decoration and sculpture, to which we must attribute encaustic painting and chryselephantine statues.

In Asia Minor are found traces of all kinds of races and civilizations jumbled up together; this was the crucible in which the different elements of Hellenic culture were molten before they were recast in the splendid mould of Greece proper. Here we find

Cyclopean walls, carpets carved out of rock as in the Sepulchre of Midas, imitations in stone of wooden structures such as the Lycian tombs [Illustn. xv, 61], now in the British Museum, the sepulchre of Myra; composites of jumbled styles, such as Ionic columns with Doric entablature and Egyptian cornice. The imitations in stone were copies of funeral piles, whereas the dwellings of the inhabitants themselves were of stone, as can be seen on the basso-relievos. All this proves that the Greek orders had no definite separate origins, but were evolved out of a chaos by the analytical mind of the Greeks.

We call your attention to the temple of Assos, not on account of its beauty, but because Semper thinks he can prove, firstly, that it is of Asiatic origin, which he does by comparing the figures on the architrave with those of Persepolis; and secondly, that these basso-relievos are imitations of the metal casing of wooden architraves. To do this, he compares them with metal relievos bearing exactly the same figures, amongst others the fish-god, found at Perugia and now in the British Museum, and also with the rock portal [Illustn. xvii, 79], belonging to a sepulchre at Corneto in Etruria.

In order to understand the early architecture of Greece we need only take Homer's descriptions of palaces literally, for they agree perfectly with what remains of that period. The treasury of Atreus at Mycenae still shows a few traces of the metal casing which once clothed it inside and out; the marble columns and the framing round its door bear the character of hammered metal-work, a tradition which endures to this day, and is the key to our architrave mouldings. The transition from metal-work to marble surprises us when we speak of architecture, but is admitted as quite natural in such objects as candelabras, where the marble-work still preserves the characteristic sharpness of the metallic models it copies.

We have seen that the Assyrian construction is hollow, and depends on the solidity of its surface, while, on the contrary, the Egyptians keep structure and clothing apart. The Greeks unite both principles in their temple, of which the construction is Egyptian, the walls being stone bonded throughout, Isodom not ashlar, but the design thereof follows the lines of the Assyrian hollow-work. The outside surface of the Greek temple is freed from the material features and constructive purpose of its Oriental precursor, and remains only an abstraction into which the Greek puts life. Whatever of the Asiatic model serves to strengthen the feeling of action and reaction is maintained, whatever does not give expression to these dynamic forces is abandoned, and thereby the column becomes gracefully animated. Greek architecture cannot fully attain its ideal without colour, for colour alone can banish all idea of substance or piecemeal construction, and yet remain inseparately united to the work, and thereby replace the materialistic Oriental decoration of gold, ivory and precious stones.

The first step between the metal architecture of the heroic period and Greek art proper was taken when metal was replaced by stucco and terra-cotta for the clothing of construction. Examples of this transitional state of architecture are found in Sicily and other parts of Magna Græcia, with the terra-cotta casing still recognizable amongst the débris.

Thanks to this transition, terra-cotta has had much influence on the development of

the architecture of the Hellenic and Italic races, as manifested in the Doric and the Corinthian styles which are equally ancient. We can recognize, for instance, that the transformations of the Doric cap and the Grecian earthen vase occurred simultaneously; the complicated and clumsy forms precede the simple and elegant. The oldest pottery was fashioned by the hand only, on the same principle as embossed metal vases,[28] a process which leads naturally to richness of plastic decoration as a disguise to the imperfections of the general shape; later on, with the introduction of the wheel, the character of the vases entirely changes; their surface is worked smooth, great pains are taken to produce a graceful outline, and their decoration is due to colour only.

The same changes of taste are found in architecture. The older buildings are overladen with plastic ornament, a taste which the Romans always preserved, but with the Greeks smooth surfaces gained favour, and at the best period of their art, the walls of the cella belonging to temples were decorated with painting only. At all times, the whole of the work inside and out was coloured, but in the older buildings, the basis of the colour decoration was yellow ochre, and very few colours were used, just as with the older earthenware. On the other hand in the buildings of Attica, after the introduction of marble, red preponderates, and the colours are rich and varied, so that the white marble, instead of bringing with it the abandonment of colour was, on the contrary, the occasion of a much richer decoration than before. Such are the conclusions of Semper, gathered from close inspection of the monuments themselves, on which he has found many traces of colour, small specimens of which he has had analyzed.

With the Greeks, colour is as essential as form, and materially affects the design. For instance, a white column will look all the better for the sharp shadows of deep fluting, but a dark column requires but a slight fluting, even none at all. We are therefore not surprised to find that the Ionic columns of the Erechtheum were of a light yellow colour, whereas the Doric shafts of the Parthenon show traces of dark red.

The oneness of conception of colour and form is abandoned in the decay of Greek art, due to the reign of Alexander and its Asiatic influences. Hence we now find the old system of clothing the structure with gold and precious stones, in fact, the gross luxury of the East, cropping up again. Then, for the first time, the jointing of stones is adopted as a decorative element of architecture, and with it a new principle of art begins which found, many centuries afterwards, its highest expression in the Gothic style, eschewed clothing a building, and emphasized the constructional parts.

Greek architecture belongs to the realm of sculpture; its scheme is exceedingly simple, its merit lies in its ideal beauty. But with the Romans, architecture belongs more to the realm of engineering; it has most complex problems to satisfy, and puts its pride in the cleverness with which it fulfils its purpose. The ingenuity of the construction, the great size, the organizing power so specially Roman, grandeur and unity of effect, become more and more a subject of admiration. The refinement of form, on the other

[28] In a visit to Palæstrina in 1876, I found that the making of embossed copper vases is the staple trade of the place, and that the workers still follow ancient traditions without any change whatever since the times of Pompeji.—L. H.

hand, is less esteemed, and must give way to practical considerations. Whereas Greek work (very much like the Greek character in politics) by its incapacity of adapting itself to great combinations, lost all *raison d'être* outside its native land; Roman architecture, the exponent of the administrative capacity of a truly imperial race, conquered the world and survives the people that created it.

The Romans had inherited building traditions common to all Indo-Germanic races, and thanks to their conservative spirit remained faithful to many an old feature which the Greeks, gifted with higher artistic instincts, had long given up, as for instance the love of exuberant plastic decoration derived from the infancy of earthenware. According to Semper, the explanation usually given of the genesis of Roman architecture is a mistake. The superposition of stories of arcades flanked by columns was no new invention, no bungling attempt to decorate a Roman structure with Greek columns glued on, but was simply the continuation of the oldest traditions of building such as we have found them in China. Here we have the clothing principle again in the old Italic dwellings; the storeys and the roof were borne by posts or columns quite independently of the walls, which were but enclosures built of sun-dried bricks protected by stucco—a system of construction which is retained throughout the Roman period. The Thermæ of Diocletian (now Sta. Maria degli Angeli, near the railway station) have the whole weight of their immense vaulted ceiling and roof supported by eight monolith granite columns, 5 feet in diameter, which stand about 2 feet in front of the walls, whereas the walls themselves have nothing to carry, and are simply the enclosure. When we look at this hall, we cannot help being reminded of the Assyrian palaces, with their large interior court-yards protected by a velarium suspended to gold columns; the resemblance is all the more striking as the ceiling of the Roman building has neither ribbing nor groining like the Gothic vaults, but is decorated all over by coffering of carpet pattern like the façade of the sepulchre of Midas [Illustn. xvii, 77, 78].

In the Colosseum and other buildings, the wall, it is true, became the real bearer of the structure, but not in appearance. The walls were coloured so as to separate them clearly from the columns and entablatures which face them; the arch was treated as an opening with the framing customary to doors and windows, and with no indication of its construction by voussoirs; the lower part of each wall up to the impost moulding received a dark colour in imitation of the breast walls and temporary draperies which used always to span the intercolumniations of porticos; and the upper part was painted blue to indicate that it was to be considered as an open space between the impost and the entablature.

This utter denial of the wall as the bearer of the structure is a denial which was modified by the introduction of the *keystone*, a feature which the Greek artists employed in Rome, and was invented as they did not like the great distance between the columns, a dislike foreign to the Romans who were accustomed to the wide bearings of their wooden temples cased with terra-cotta. From that moment the wall begins to tell as bearer, and unites the functions of column and enclosure. This change brings us one step nearer to Gothic architecture.

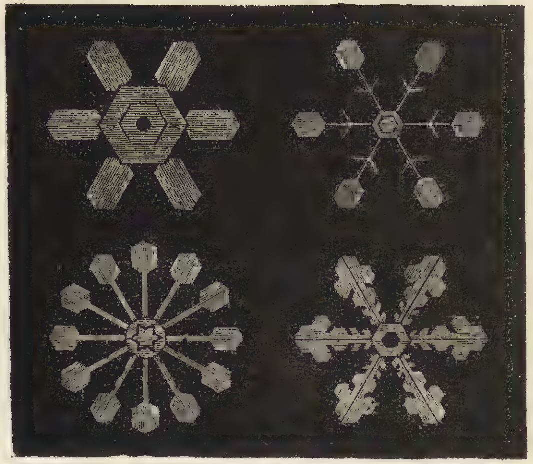
III. SEMPER'S THEORY OF EVOLUTION IN ARCHITECTURAL ORNAMENT (ix)

Introduction.

MAN copies nature in the way of shaping the works of his hands. The shape of natural objects, such as crystals, plants, and animals, is a result of the conflict of the forces of nature, such as molecular attraction versus repulsion, the germinating force of plants, the forces of animal growth and of will, in opposition to the forces of inertia and gravitation.

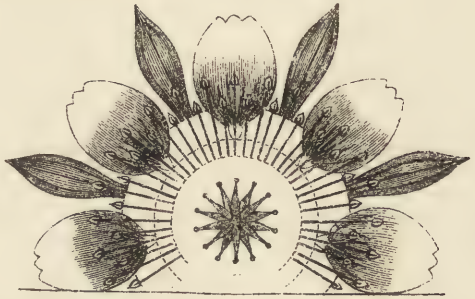
As an outcome of these forces we find in nature the following characteristic elements of form :—Eurythmus, Symmetry, Proportion, Direction, and Bias (Latin, *auctoritas*),—by this word we mean that in a given object one of the elements of form predominates and gives the object its peculiar character : *proportion* predominates in trees and towers ; *direction*, in fishes and cathedrals.

24. The different appearances of the Comet of 1680 illustrate form as generated by motion.



25.

Snow Crystals are a natural illustration of Eurythmus. These formations of regular parts radiating from a central kernel exclude any reference to the world outside them. Crystals have neither top nor bottom, neither Symmetry, Proportion, nor Direction, except in their parts, which show us that Symmetry is the result of Equilibrium, and that Proportion is caused by the conflict of Atomic attraction and repulsion.



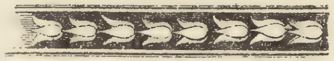
26. This portion of a flower shows us that Symmetry is also a part of Eurythmus ; Eurythmus becomes Symmetry as soon as it is considered in relation to some object outside the plane on which it stands.

III. SEMPER'S THEORY OF EVOLUTION IN ARCHITECTURAL ORNAMENT (x).

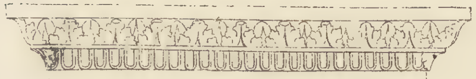
Many of the rudimentary forms of Architectural Ornamentation have sprung from the ornamentation of the human body. As an example we give the Wreath, an ornament worn by the ancients in all important ceremonies both civil and religious.

27. Wreathing for a religious festival (from Egyptian basso relievo).

28. Wreath or Necklace passively neutral as to the direction of its component parts.



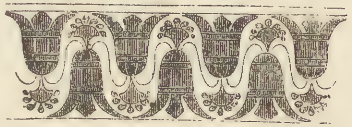
30. Wreath with flowers directed from right to left.



31. Wreath with leaves turned upwards as a crowning feature to a cornice.

32. Wreath with leaves turned downwards in the mouldings of a base.

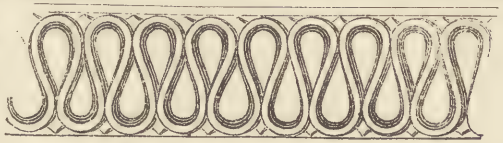
33. Necking of Greek Vase decorated with flowers pointing upwards and downwards, as an indication of its double use as receiver and outpourer of liquid.



34. Wreath actively neutral, its flowers being alternately directed upwards and downwards.

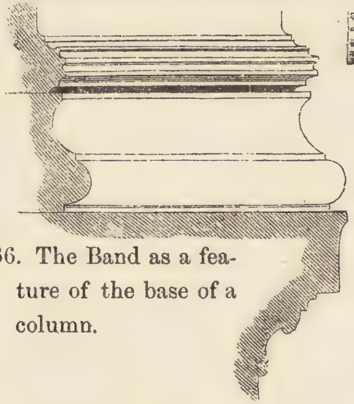
Note.—The component parts of an ornament may suggest a given direction, upwards or downwards, right or left. If they suggest no direction, we call the ornament formed thereby neutral. If the parts themselves suggest no direction, the ornament is passively neutral; if the parts point equally in two directions opposed to one another, the ornament becomes actively neutral.

29. Vertical conventional ornament with neutral necking.



35. Neutral as above, but conventional ornament.

THERE are also many Architectural Ornaments derived from the primitive products of man's industry, such are the Band and other architectural features which have been adopted from textile work.



36. The Band as a feature of the base of a column.

37.

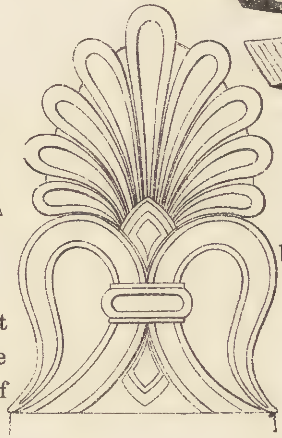
38.

39.

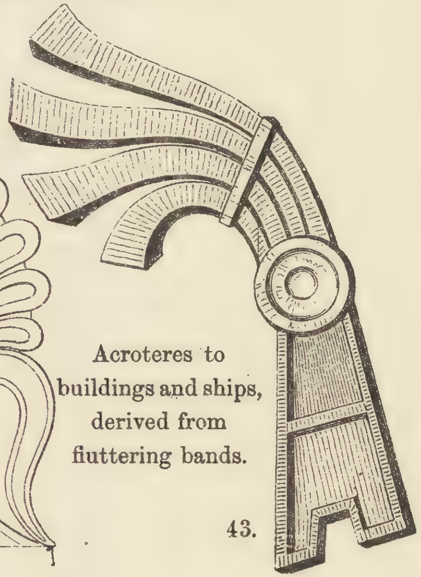
Different ways of strengthening the appearance of a Band.

40. Flat Band, used for the border or the edge of a piece of stuff.

41. Fluttering Ornament to Helmet, to emphasize the rapidity of motion of the wearer.

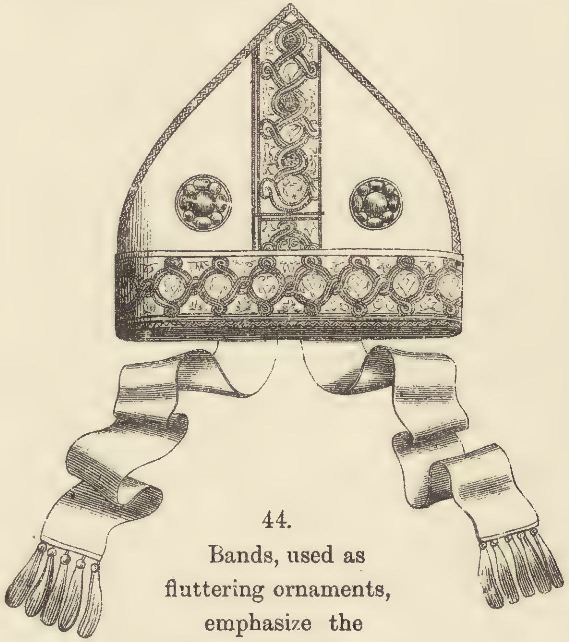


42.



Acroteres to buildings and ships, derived from fluttering bands.

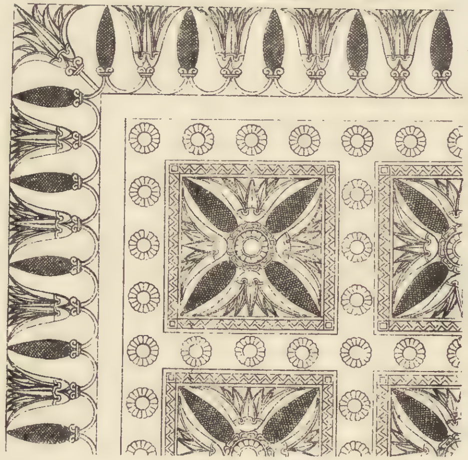
43.



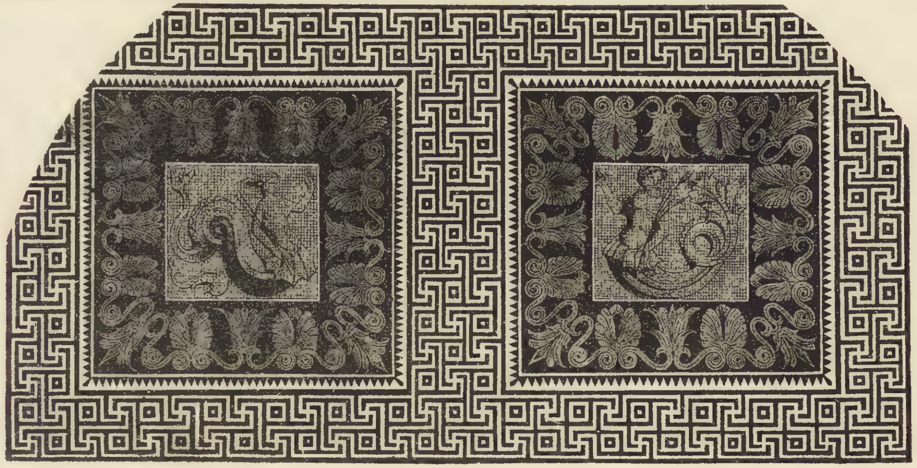
44.
Bands, used as fluttering ornaments, emphasize the direction of the wearer in processional march.

Architectural Ornaments derived from Textile Products.

45. Roman Pavement, measured and drawn by Semper, in a cellar at Orange, in 1830.—Observe the further development of the woven border and the seam.



46. Assyrian Carpet engraved on a stone slab (Brit. Mus.)—Note the figured seams.



47. Mosaic Pavement in Pronaos of the Temple of Jupiter at Olympia.

General border framing the whole of the pavement.

Figured seams connecting the two fields with the border that surrounds them.

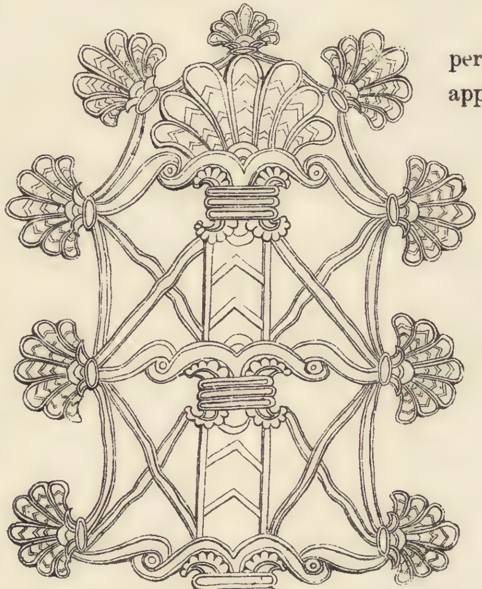
The fringe directed inwards growing out of the border, indicating that this pavement belongs to a passage, not to a room.

The figures in the fields have their heads turned towards the interior of the cella, so that they should stand erect for persons looking in from outside. Semper says that figure subjects are in general to be avoided in pavements, as they are not a fit object to walk upon; but they are allowable in positions never or rarely to be trodden, as a kind of foreground to a Sanctuary. That figures do not seem so objectionable in mosaic pavements as strict theory would lead one to believe, is due to the strongly-marked joints of the mosaic stones, which prevent mosaic pavements losing their character of ornamental surfaces or stone carpets.

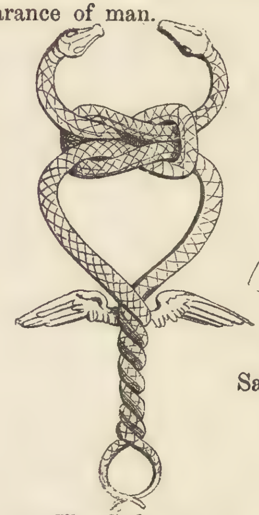
Mosaic pavements are carpets imitated in durable material.

The KNOT, as representative of the idea of Necessity, is one of the earliest Religious Symbols.

Knotted Serpents, as a religious symbol, are to be found everywhere. They are, perhaps, an allusion to the primeval chaos, and its serpent fauna, which preceded the appearance of man.

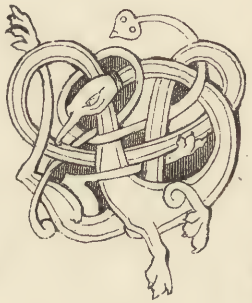


48. The Sacred Tree of the Assyrians. A Symbol derived from the processes of plaiting and knotting.

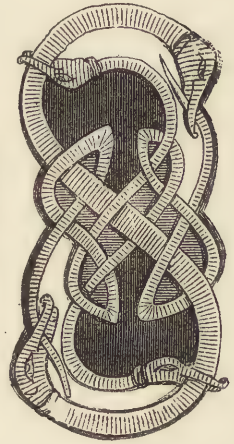


49. The Caduceus of Hermes (Greece).

50. Egyptian Sacred Head Dress, with Aspic.



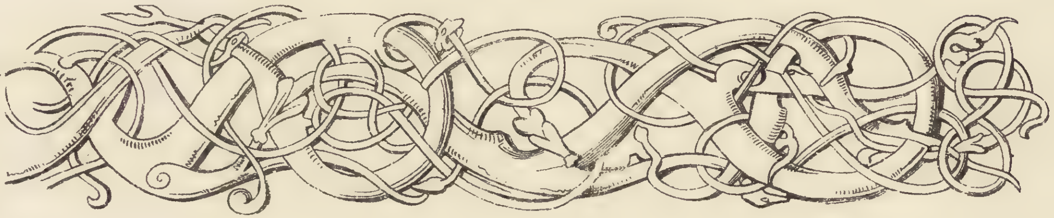
51.



52.

Irish and Franco-Saxon Ornaments formed of Knotted Serpents.

Parts of this Sacred Tree have found their way into furniture and architecture, as ornaments to emphasize the structural functions of their parts, as well as to give a religious character to the object ornamented.



53. Scandinavian Carved Scroll of Knotted Serpents.

EMBROIDERY IS THE PROTOTYPE OF ALL MURAL DECORATIONS. There are two different processes of Embroidery, namely:—

54. OPUS PLUMARIUM,
or Embroidery in Feathers or Satin-stitch.

This Example is taken from modern Tyrolese work in feathers.

The Opus Plumarium is the earliest process of Embroidery; it allows nearly the freedom of the paint-brush, and gives a decoration in relievo more or less thick. Semper considers that the Opus Plumarium is the origin of basso relievos, and therefore also of statuary and painting.

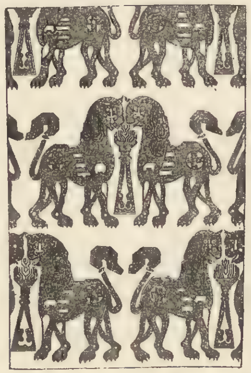
54.

55.

55. OPUS PHRYGIONUM,
or Embroidery on a Canvas ground.

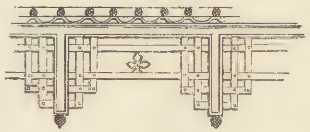
This Example was found on a Mummy in a grave at Sagnava, and is therefore probably 6,000 years old.

The Opus Phrygionum is only well suited for regular mathematical patterns: it was probably the model followed for ornamental weaving for carpets, &c, and can therefore be considered as the earliest prototype of mosaic pavements.



57. New Babylonian Silk Wares, from which Byzantine ornamentation was derived.

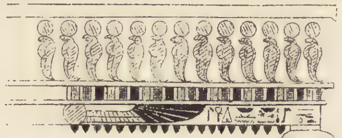
56. Roman Silk Ware, from Sion in Switzerland.



58. Chinese Trellis-work derived from Textile products.

59. Brass at Bruges, A.D. 1387. Shows influence of Silk Wares in decorating.

Clothing is the idea which presides over the Decoration of Temporary Festal Structures. The use of metal in building began with clothing wood structures with gold plating.

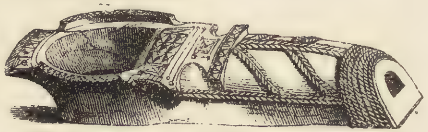


60.

60. Temporary decoration of a Post, origin of the Egyptian column.

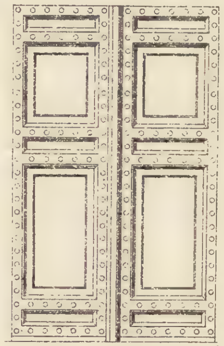
61.
Syrian Tomb. (Brit. Mus.) Imitation of funeral pyre (see basso-relievos).

62. A Roman Funeral Pyre, from a medal. Prototype of monumental tomb.



63. Assyrian Sarcophagus, in glazed terra cotta, imitation of winding sheets.

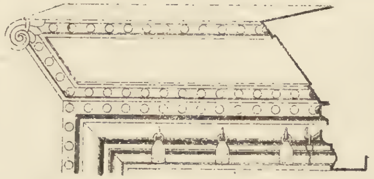
Monuments are but temporary structures imitated in durable materials.



65. Bronze door, Pantheon.

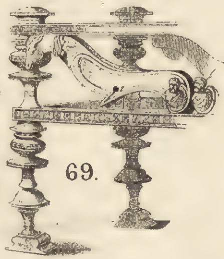
64. Door of the Temple of Remus.

66. Door of the Pantheon.



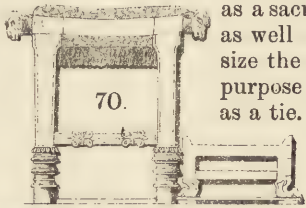
67. Doorway of St.ª Sophia.

These doors show the evolution from metal plating to metal casting.



69.

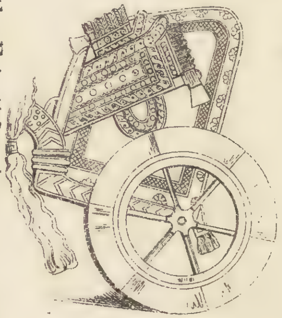
69. Etruscan Bedstead, — Tin-ware style of metal-work.



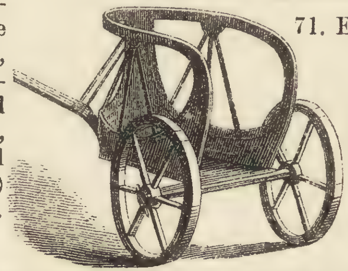
70.

The claws of the footstool suggest that it is a moveable object.

70. Assyrian furniture plated with metal. The pair of volutes on the cross-bar are taken from the holy tree, and mark the stool as a sacred object, as well as emphasize the structural purpose of the bar as a tie.



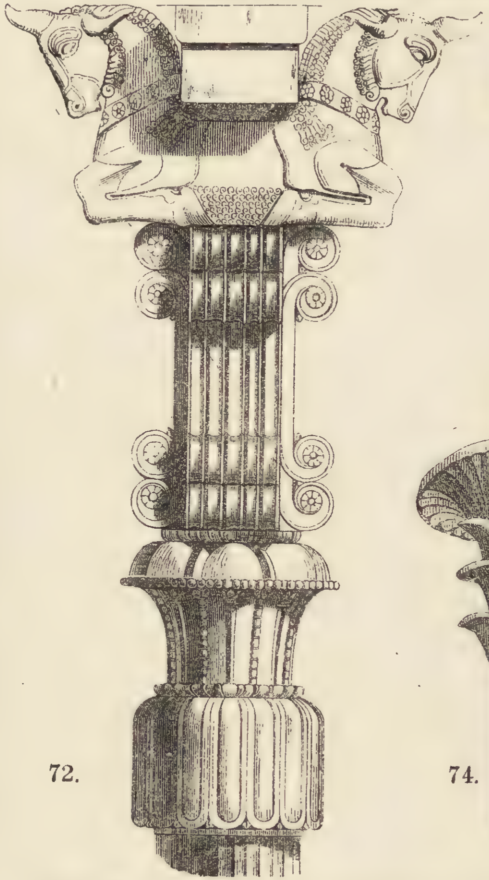
68. Assyrian Chariot. Its heavy proportions, seen in conjunction with the galloping horses, show that it is either made of wood plated with metal, or of beaten metal (Repoussé work) with a hollow kernel.



71. Egyptian Chariot, Is made of solid metal, hence its light appearance.

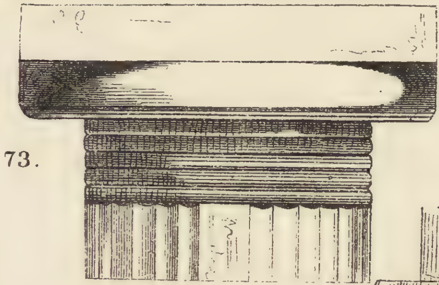
These two Chariots characterise the principles of construction which differentiate Assyrian from Egyptian buildings, the *hollow* versus the *solid* wall or column.

The characteristic Forms due to the use of Metal are followed when Stone instead of Metal is used.



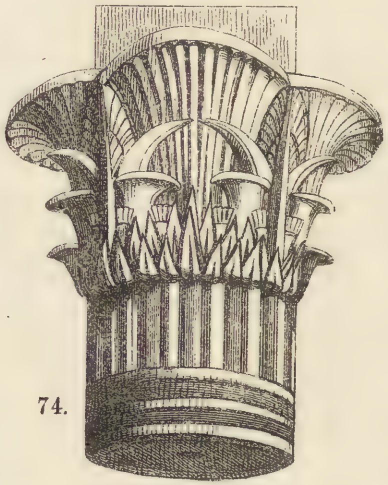
72.

72. Marble Persian Column, close imitation of Metal Work in the tinker style.

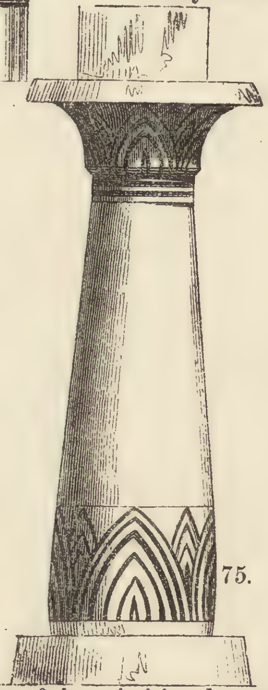


73.

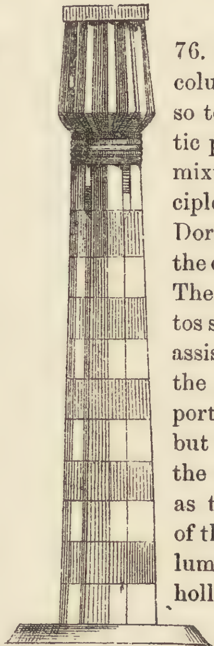
73. Egyptian Proto-Doric Capital belonging to the transition period between the feudal state and the theocratic monarchy which succeeded it. Its fluting suggests to Semper the hollow corrugated shafts of Assyrian columns.



74.



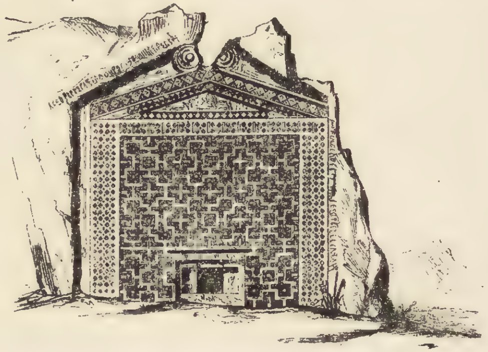
75.



76. This Egyptian column belongs also to the theocratic period. It is a mixture of the principles of the Proto-Doric order and the decorated post. The clothing of lotos stems and buds assists in carrying the weight supported by the post, but does not take the whole weight, as the outer skin of the Assyrian column formed of hollow metal.

74, 75. Egyptian Capitals and Column of the Theocratic period. Imitation of the primitive decorated post, a purposely designed archaism, as a suggestion of the antiquity of the religion and traditions of the Egyptian priesthood.

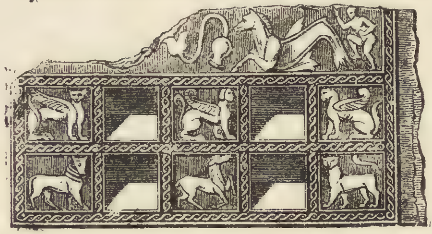
The Ornamentation of Roman and Greek work is governed by the Clothing principle.



77. Tomb of Midas.
Rock carved in carpet pattern, probably covered with stucco and colour.

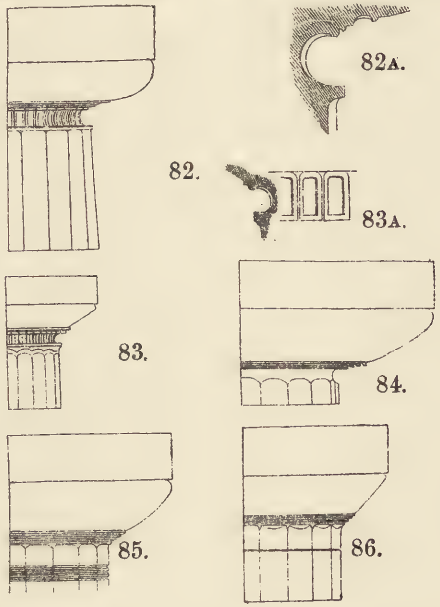
78. The Thermæ of Diocletian.
The vaulting is decorated as a velarium, with a pattern similar to the Tomb of Midas.

79. Temple of Assos.
Specimen of Doric architecture anterior to Greece. Compare its ornamentation with the door of Corneto.



80. Etruscan door to sepulchre carved in the rock at Corneto, in imitation of repoussé metal work.

81. Terra cotta Capital from Sicily. Shows how terra cotta influenced Roman work, whereas the Greek Corinthian caps of the Choragic monument have the sharpness of metal work.



Doric Caps, of different epochs. The plumpest and most complicated are the oldest.

The further history of Roman architecture is like that of the Roman Empire, split into two parts. The Christian religion had brought with it a new spirit which menaced to overthrow the empire. In the East, Christianity was quietly adopted by its arch-enemy Constantine, who, not being able to strangle it, turned it into his slave. We are therefore not surprised that the Christian architecture of Byzantium is the old Roman architecture imbued with the spirit of an Oriental court, and that it was easily adopted later on by the Mohammedan and other despotisms of the East. In the West, the Church was not only free but mistress; her principal dogma of the crucifixion of the flesh led her to the abandonment of the sensual decorations of Pagan art, and as the structure was divested of its clothing the construction itself and its material rose into artistic importance. The evolution was a slow one, for even until the end of the twelfth century the walls inside churches were decorated with mural paintings, in principle like those of the Athenian temples; but little by little the wall space disappeared, to make room for a system of architecture in which construction left no more field free for either painting or sculpture, except in very subordinate positions, and thus arose Gothic architecture of the later period.

The architects of the Renaissance believed they were restoring antique art, whereas, thanks to their ignorance of the real state of the case, they only adopted a few features of the ancient buildings, and created therewith an architecture of their own superior to anything which had preceded them. They did not know that the ancient buildings were always painted, and of course found them very tame; this led them to seek richness of effect in the contrast of light and shade, in the plastic decoration and surface treatment of the stone; such is the development of the Renaissance from Bramante's rather dry work to Borromean exuberance, which is the starting point of a new artistic decadence.

Semper's first volume closes with a powerful defence of his opinion on ancient polychromy, with copious quotations from Greek and Latin authors, as well as illustrations from the buildings themselves. In this dissertation he triumphantly answers Kugler's criticism, a translation of which appeared in our TRANSACTIONS for the year 1835-36. In this argument I do not think it worth while following out our author. Our convictions are settled. No person who lays any claim to a liberal education now doubts that the buildings and the statues of the ancients were coloured. But it was quite a different thing when Semper wrote; he was one of the first to mention this discovery, and he was the only one who connected it with a complete theory on the art of the ancients. In 1832, feeling sure that he would find traces of colour in such parts of Trajan's column as were protected against the weather, he had himself let down with a rope to inspect the under part of the capital, and, to his satisfaction, he found undoubted remains of colour which he describes. Knowing the opposition his opinions excited amongst artists, he invited all the foreign architects then resident in Rome to make the same inspection with him, and to sign an attestation of what they had seen; but such is the power of prejudice that, even after that, doubts were expressed, all kinds of weak reasons were given to explain the matter; it was even suggested that Semper himself had painted on the colour to mystify his colleagues.

I intended to give an account of all that has been published of Semper's work, but I find that, even with the first volume only, I have passed the limits such a paper should have. I am afraid that I have not done justice to my eminent master's teaching, for, in such an abbreviated form, I have been obliged to mention only his leading ideas and omit the accumulation of facts and the refined analysis he employs to prove their correctness. Many persons could give a rough sketch of a picture, just as everybody may utter bold and even correct opinions, but the master-hand of a great artist alone can work it out. I think, therefore, that what is most important in Semper's teaching is expressly that which I am obliged to omit; I believe that the benefit to be derived from his book consists mainly in following out his arguments, probing his quotations, examining critically his examples as an opponent would do. It is in that spirit Semper wished his book to be read, for says he: "I write not for lazy readers."

When we consider the immense field reviewed in the 567 folio pages of close printing which form Semper's first volume alone; the great erudition shown by more than 520 quotations from authors, ancient and modern; the thorough dealing with nearly every product of man's hand or brain; the vast synthesis by which the author unites all arts in a few general principles; and when we remember that Semper wrote this great work, notwithstanding his adventurous life as a political exile, and the numerous buildings he designed and carried out as an architect, many of which belong to the masterpieces of our century, we cannot help being astounded at the genius of the man.[29] For my part I much regret that we did not keep him amongst us, when, by accident of fortune, we had it in our power to use his splendid gifts for the development of the arts of our country.

LAWRENCE HARVEY.

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[29] I cannot conclude without quoting from a paper which appeared in *The Architect* of 27 December 1884, from the pen of Professor G. Baldwin Brown, as follows:—"Few students of artistic history have "read Semper 'On Style' without feeling that its perusal made an epoch in their studies. Possessing a "philosophic mind, he surveyed with a rapid glance the artistic development of the human race as a "whole, and it fascinated him to trace the working of great principles through widely differing times or "places. One great interest of Semper's treatment of his subject is its thorough accordance with the "modern scientific method. He never rests in a fact of art-history as it stands, as does his contemporary "and rival theorist, Karl Boetticher, but eagerly follows it backward to its origin. Development is to "him the key to artistic history; and though he is as convinced as the author of the *Tecktonik der* "*Hellenen* himself of the supremacy of the Greeks in matters of style, he derives the forms they used "from the arts of earlier peoples. This does not in any way tend to lessen the artistic achievement "of the Greeks. It is now clearly seen that in no sphere, except perhaps the political, were they great "originators. They were form givers. Receiving art, religion, letters, science from the East, they fixed "upon each alike a distinctively Hellenic stamp and made it entirely their own. The Doric temple, "Boetticher and Semper would agree, is distinctively a Hellenic production; but while the former "regards it as having sprung forth complete 'like Athene from the head of Zeus,' a stone building and "a Greek building from the first, the latter, in a more scientific spirit, traces back its origin to wooden "structures clothed with draperies and colouring, and associates it with the architecture of other ancient "peoples. In accordance with this view of development, Semper derives the monumental architecture "of the ancients from festal structures of a temporary kind, and in doing so sets the art in a new light. "Architecture no longer has a servile element; it no longer must be held to begin in structures for use "or for protection, but in its position as a fine art it is from the first an art of expression, the outcome of "religious or patriotic enthusiasm."—L. H.

IV.

THE GODWIN BURSARY: REPORT OF A VISIT TO VIENNA AND BUDA-PESTH. By Mr. Frederic R. Farrow.

[Addressed to the Council of the Royal Institute of British Architects, November 1884, and read on Monday, 5th January 1885, Ewan Christian, *President*, in the Chair].

Mr. President and Gentlemen,—

IT is with very great pleasure that I have to present to you my report on the studies and examinations made by me as Holder of the Godwin Bursary for 1884, and in doing so I desire to express the thankfulness I feel to the munificent founder of the Bursary for the opportunities that have thus been afforded to me for special studies which I feel have been of great benefit to myself, and which I hope may, by the means of my report, prove to be of value to others also. In accordance with the terms of my engagement, I visited the cities of Vienna and Buda-Pesth, the greater portion of my time being spent at the former city, as I found that, while in Vienna there was more than enough to profitably occupy the whole period of my visit, at Buda-Pesth there are so many modern buildings of importance and high class that to properly study them would require a stay of at least two or three weeks.

I started with the intention of gaining information upon the two subjects of scientific character—Acoustics and Ventilation—that have of late had most interest for myself, and I also wished to take note of any peculiarities of Building Construction which I might meet with in the course of my visits, though I did not regard this latter subject as the chief object of my studies. It is my purpose, therefore, to divide my report under the three heads—(1) Acoustics; (2) Ventilation; (3) Building Construction; and in addition, there are a few memoranda of more discursive character containing information obtained in conversation with some of the members of our profession in Vienna.

It would, I think, be out of place for me in this report either to advance theories of my own on the subjects I have taken up, or to criticise the theories of others, and I have therefore confined myself to the record of facts, and where possible the statement of the reasons given by the authors for various dispositions. In this last particular I was unfortunately much hampered by the absence from the city of the leading members of the profession in Vienna and Buda-Pesth during my visit, and especially so in the case of Professor Dr. Böhm and Herr Baurath Paul, the two principal authorities in Vienna on the subject of ventilation. From this cause, too, I was unable to examine the New Courts of Justice, Herr v. Wielemans, the architect, being away; and as the Courts have not yet been used, proof of their acoustic qualities, which I had intended to study, was wanting. I have endeavoured to make my report as explicit as possible, but should it appear to the Council that further light is desirable upon any particular subject, I shall be glad to clear up any points that may be more lucid to myself than to others.

Acoustics in Vienna.—The scientific study of the laws of acoustics and their practical application to halls of audience are but slightly appreciated in Vienna as far as I was able to learn. They do not find a place in the curriculum of the Technical High School or of the Academy of Arts, and the very term "Acoustics" is hardly known to many of the architects and engineers whom I met, so that I was often obliged to explain what we mean by the acoustics of public buildings when endeavouring to seek information on

the subject. The usual answer to my enquiries was a bold confession of the exceedingly difficult nature of the subject, and the almost impossibility of obtaining reliable data. The chief exception to the general indifference on the subject I met with was in the practice of Baron v. Hansen, who has found from experience that good acoustic results are obtained in halls whose length is twice, and height one and a half times, the width. He has successfully adopted these proportions in the upper and lower chambers of the Houses of Parliament, in both of which the result is most satisfactory. I was unable to learn that Baron v. Hansen has any but empirical reasons for the employment of these particular proportions.

In visiting the Houses of Parliament I took notice of the following points as bearing upon the acoustic properties of the Chambers :—

(1) The plan is in each case that of a half circle with a recess on the diameter, containing the seats of the presidents and other officials. Two galleries run round the halls, the upper set back from the face of the lower, which is carried on iron cantilevers.

(2) The ceiling is flat, and constructed of iron and plastered brick, a portion of the surface being occupied by a flat ceiling of iron and glass. The walls are plastered or lined with marble slabs.

(3) The seats are arranged on an isacoustic curve, the rise of those in the rear thus being greater than that of those in front. They are constructed of wood carried on wood framing, and with an air chamber below, which is also floored with wood.

(4) There is a constant flow of fresh air proceeding from under the seats of the members (as explained in my report on Ventilation) and passing towards the seat of the president. The members speak from their respective seats, and do not occupy a rostrum when addressing the house.

The new Opera House is I understand very successful acoustically, the form is in plan a horseshoe, the proportion of the length to the width (between the fronts of boxes) being 4 : 3, the height equals the width. It has neither projecting galleries or balconies, nor recessed pit, these features being avoided by the architects for the sake of acoustical effect and the house has therefore the semblance of a number of boxes. The ceiling is flat and coffered and has a deep cornice. The floor of the arena is of wood with a large open space under, forming the mixing chamber for the ventilation, and there is a constant current of fresh air passing through the building.

The Volks-halle, the smaller public hall in the Rath-haus, about 77 ft. long, and vaulted in brick and stone, possesses good acoustic properties; its dimensions of height and width are equal and its length is two and a half times the width, while the walls are plastered. The Council Chamber and the grand Ball Room have not yet had their acoustic properties put to the test, and I could not learn from the architect's assistants that any special arrangements had been made to obtain good results.

In the University buildings, containing fifty lecture rooms of varying sizes, I naturally expected to find that considerable attention had been paid by the architect, Baron v. Ferstel, to the acoustical qualities of the various rooms, and I noted that the following points had been adopted. The rooms are all ceiled with wood below the fire-proof floors, which are insisted on by the Building Act of Vienna, and are carried by iron girders cased with wood and projecting below the ceiling level. A wood panelled dado, 6 ft. 4 high, runs round the rooms, and the walls above are plastered. In the larger rooms the seats are arranged on an isacoustic curve. The rooms have a constant current of air passing through them. The proportions of the rooms do not appear to have been in any way rigidly studied. The lecturer's rostrum is raised above the floor 3 ft., and has a sounding board over to assist in concentrating the speaker's voice. The rooms already in use are, I was told, found satisfactory by the professors.

The Meeting Room of the Society of Engineers and Architects possesses good acoustic properties; it is a parallelogram on plan, its height is half the length, but the width is incommensurable, being a little more than the height. The ceiling is flat and coffered, and there is a light gallery running round the two sides and end. The walls are panelled with wood, and there is a constant stream of air passing through the room.

Ventilation in Vienna.—Very great attention has of late years been paid to this subject in Vienna by the architects and engineers of the city, and large sums of money have been spent to obtain satisfactory results in the application of various systems to the great public buildings. The attention of the public to the necessity for the proper ventilation of large assembly rooms has been aroused chiefly, I understand, by the initiative of Professor Dr. Böhm and his successful treatment of the new Opera House. Professor Böhm's system in various forms has been adopted in the majority of the new

monumental buildings of Vienna, and, although exceedingly costly, has been very satisfactory where introduced. The leading features of this system are the following:—In the basement of the building three chambers are constructed one above the other; into the lowest the fresh air from the external atmosphere is admitted, and from this chamber, which is called the "cold air chamber," are supply channels to the two upper chambers. In the middle of the three are coils of hot water or steam pipes, by which the temperature of the incoming air can be raised to the necessary degree, and this is named the "hot air chamber;" the uppermost chamber has supply channels to it both from the cold air chamber and the hot air chamber, and is termed the "mixing chamber" (Mischraum). The air is admitted from the two lower chambers in such proportions as may be necessary to render the air in the mixing chamber of the desired temperature. From the mixing chamber the fresh air is propelled by means of a fan through supply flues in the walls to the inlets in the various apartments, and is admitted in the winter by openings near the ceiling, in the summer by openings near the floor, the reason assigned for the arrangement being this, that in winter the fresh air enters warmer than the normal atmosphere of the room and cooling falls naturally to the floor, in summer the fresh air enters cooler than the normal atmosphere and becoming warmed rises naturally to the ceiling. The fresh air being thus admitted, the foul air is extracted through similar wall channels by a second fan of the same dimensions and worked by the same engine at the same speed as the first, and having been drawn down again to the basement is expelled at a part of the building as remote as possible from the fresh air primary intake. The outlets for the foul air in the rooms are arranged conversely to the inlets, the foul air exit in winter being near the floor, in summer near the ceiling, and the inlets and outlets are respectively arranged to produce, as far as possible, a current passing diagonally through the room.

Having thus sketched-out the main principles of Professor Dr. Böhm's system, I propose to show how this system has been applied to the various buildings I have studied, especially in the new Opera House, which is at once the first chronologically and the simplest in its general scheme, and the new Rath-haus, which is, I think, the best example of an application of the system to a building of varied and complex character.

Opera House.—The very successful scheme of ventilation for this large and important building was devised by Professor Dr. Böhm with the assistance of Professor Dr. Heger, and furnishes the first notable example in Vienna [Illustn. xviii]. Fresh air is supplied to an audience of over 3000 at the minimum rate of 900 cubic feet an hour for each person, and enters with a velocity of 1 foot per second. The fresh air enters from the garden at the side of the building into the cellar A, passing through a water-spray shower, which washes it from dust and also cools it for summer use, so that the temperature within the auditorium is frequently in hot weather below that of the external air. From A it is drawn through a circular channel, 7 feet 6 inches diameter, by a 10-feet fan B, from which it flows by a rectangular corridor 45 square feet in section, and this shortly divides into three channels, the middle one, 32 square feet in section, supplying the arena and boxes, the others, $12\frac{1}{2}$ square feet each, supplying the galleries. From these channels the air enters the lowest of the three chambers already described as forming an essential feature of Dr. Böhm's system, the cold-air chamber C, and then flows either through the cylindrical tubes D, 3 feet diameter, direct to the uppermost space, the mixing chamber E; or by openings, F, round the tubes to the heating chamber G, where it is warmed by passing over steam-pipes, and then ascends to the mixing chamber E. From the mixing chamber the air enters the auditorium, at the rate of 1 foot per second, through the risers of the seats in the pit and through vertical wall channels to the corridors of the pit boxes and the first and second tier of boxes, and from the corridors enters the boxes themselves through openings in the doors. The upper galleries and boxes are supplied similarly from the lesser channels already mentioned. The area of the openings for the in-streaming fresh warmed air is as follows :—

	Pit	554	square feet.	
	Pit passages	28	„	
	Pit boxes	28	„	
	First tier of boxes	28	„	
	Second „	28	„	
Same level	Third „	14	„	
Same level	First gallery	28	„	
	Second „	42	„	Total . 750 square feet.

The foul air from the pit and boxes ascends naturally, assisted by the heat of the central gaselier, and is collected in the great cylindrical tube H, and the foul air from the galleries passes through separate channels I, leading from their ceiling and joining the central tube H, to which also enters a branch channel K from the stage. From the collecting tube H the foul air is expelled at the roof by the fan L.

In order that this great system may be thoroughly under control, telegraphic thermometers are placed in all parts of the house and communicate with the inspection room M, where the engineer in charge of the ventilation can at once see if the temperature of any part of the house is above the proper standard, and can telegraph his instructions to the engine-room or regulate the supply of fresh air or rate of extraction. At the time of my visits to the Opera House (August) the standard temperature for different parts of the building was fixed at from 65° to 73° Fahrenheit [Illustn. xviii].

Rath-haus.—The ventilation of this very complex building is divided into four sections—(1) the Grand Ball-room or Fest-saal; (2) the Rath-haus Cellars; (3) the Council Chamber; (4) the large Public Offices. The fresh air enters under the arcade to the room A [Illustn. xix], whence it is drawn by the fans C, and proceeds by the air passages D-D_5 to the heating chambers. The air passage D_3 D^4 divides the fresh air into two streams, of which one goes through the small heating chamber H, from which it ascends by vertical wall channels to the rooms above, while the second stream passes through the large heating chamber T, and through a channel at the right side to the great shaft G. In a similar manner another part of the air stream passes by the air passage D_4 through the chamber J to the second large heating chamber F_2, and thence to the already mentioned shaft G. The remainder of the air stream proceeds by the passage D_4 to the end of this cellar passage L, and thence by the horizontal channel N to the heating chamber P, where it is warmed for the supply of the Rath-haus cellar. The fresh warm air flows through the already mentioned shaft G to the space over the ball-room ceiling, through openings in which it passes and streams down slowly upon those below, passing through gratings in the floor and outlet channels in the walls to the collecting space under the floor, from which it descends to the cellar by the shafts K_1, K_2, K_3, Q_1, and Q_2, collects in the cellar M, and is expelled by a fan through the channel O. Thus, for the great ball-room and its adjuncts there are on each side two injector fans and one exhauster fan, in all four injectors and two exhausters, the power of which balance. In addition to the warm air which passes into the shaft C through the leading chambers, cold air can also be admitted by a channel passing below, so that the temperature of the in-streaming fresh air can be regulated to the desired temperature. In calculating for the heating-power and amount of fresh air required for the ball-room provision has been made for a supply of 40 cubic mètres each for 3000 persons hourly, and raised from the minimum temperature of 10° F. Arrangements are made also for ventilating in the contrary direction by closing with a flap the outfall of the shaft G in the ceiling space and opening two others below. The warm air can then pass by the shafts K_1, K_2 to the collecting space under the floor, from which it can enter the ball-room through the floor gratings, and, driven by the force of the fans, pass out through the openings in the ceiling into channels connected with the upper part of the great shaft G, and ascend to the roof space, and so find its way to the outer air. As the fresh air in this case passes only by the shafts K_1 and K_2, whose sectional area together is 3·14 square mètres, and the openings of the gratings connected therewith only 40 square mètres, the in-streaming air at the rate of ¼ mètre per second admits only of 36,000 cubic mètres per hour being forced in, instead of the full quantum of 120,000 cubic mètres. In summer the in-flowing air is cooled by passing over closed ice receptacles, whose enclosure forms the cooling surface, and the artificially cooled air is mixed with the in-streaming fresh air to obtain an agreeable temperature.

The ventilation for the Rath-haus cellars (or Banqueting Halls) is provided on the basis of 25 cubic mètres each for 900 persons hourly, and the cubic contents of the rooms being 8,000 cubic mètres, the atmosphere has to be changed three times in the hour to provide the required allowance of air. The arrangements are as follows:—The fresh air being warmed in the heating chamber P, as before described, flows along the great air channels U and R under the floors of the halls, and thence by a number of stoneware pipes to the outlets W in the window parapets on the one side and wall niches (forming seats) on the other, here it enters the apartments at a slow rate through gratings. As the entry of the warm air is thus slow, subsidiary steam coils are used to supplement the heating power. A branch channel T conveys the warm air to the urinals, &c. The foul air streams through openings x in the vaulting into the collecting space above, and flows thence by a number of metal tubes e to the great channel S_3. The

Central Hall not having space above the vaulting, the foul air is collected in the descending shafts S_1 and passes by the connecting channel S_2 to the great channel S_3, along which it is drawn by the fan Y, and expelled by the shaft Z through the roof space. This shaft Z also takes the foul air from the larger offices, and is accordingly divided down the centre by a partition of sheet metal. The ventilation of the Council Chamber is thus effected:—The fresh air enters from the areas *l* by the openings *i*, and is drawn along the passage *d* by the fan *c*, and forced left and right through the heating chamber I to the channels *e*, by which it is led to the vertical shafts *g*, which convey it above the roof of the Council Chamber, whence it streams down through openings in the ceiling. The foul air passes through gratings in the risers of the steps carrying the slabs, descends by the shafts *h* through the channels *f* to the exit channels *b*, whence it is expelled by the fan *d*. Provision is thus made for the supply of 40 cubic mètres each for 3,000 persons per hour, and capable of being heated from a temperature of 10° F.

The principal offices are divided into four groups for the purpose of ventilation. Each group is provided with a fan R, by which in summer the foul air is withdrawn and ejected by the shafts Z, in the case of groups I. and IV., and by the openings Z_2 from groups II. and III. To supply the fresh air, vertical wall flues from above the roof descend to each room and a circulation is thus maintained. In winter the fans are not used, but the fresh air being warmed by the heating chamber ascends to the rooms, and the foul air passes away by the wall flues already mentioned as being the fresh air inlets in summer. The fans are capable of extracting 41,000 cubic mètres of air an hour, thus allowing 20 cubic mètres an hour to each occupant of the offices. The smaller offices, &c. are in some cases heated by warm air from the heating chambers in basement, as shown on plan, as are also the lavatories, &c. The majority of the smaller rooms are heated by Haag's stoves, consisting of two hollow cylinders one inside the other, the space between them being closed and containing water which is heated by a steam coil passing through, thus a very large amount of heating surface is exposed to the air, which can be allowed to enter from openings in wall flues close to the stove, or these being closed only the atmosphere of the room circulates through the stove and becomes rapidly heated. There are 450 of these stoves in the building. The corridors and staircases are heated by the circulation of air through heating chambers, containing steam pipe in coils. There are sixty-two of these heating chambers, four of which contain as much as 1,600 mètres of pipe each.

The whole of the heating required for the Rath-haus building is thus effected by steam, and an ingenious condenser, the invention of Herr Haag, has been adopted to facilitate the separation of the condensed water from the steam. It consists of a small iron cylindrical box with an inlet and outlet pipe, over the mouth of the outlet pipe is an inverted hollow cone filled with alcohol and with the base formed of a thin diaphragm of nickel. When water only is in the condenser the mouth of the outlet pipe remains open, but if steam enters, the raised temperature expands the alcohol and so forces down the diaphragm, and closes the mouth of the outlet so that the steam does not pass away in waste. This complex system of ventilation to the Rath-haus is a modification of Professor Dr. Böhm's original scheme by Herr Baurath Paul, who has superintended the carrying-out of the work, assisted by Herr v. Schlag and Herr Haag [Illustn. xix].

The Bourse.—This is an instance of an application of Professor Dr. Böhm's system to a building of simple character and large cubical contents. The hall is 193 feet long, 85 feet wide, and 75 feet high, and is capable of accommodating 2000 persons. In this case both the injecting fan and the exhaust fan are in the basement, the foul air channels and fan being below, and the fresh air channels and fan above them. The two fans are worked by an engine of 18-horse power, supplied from two boilers, and are capable of being regulated from 60 to 300 revolutions a minute. The upper openings are in the walls near the ceiling level and communicate with wall channels; the lower openings are in the floor and covered with iron gratings. The floor is double and paved with stone, steam pipes being placed below so that the stones themselves can be warmed in winter on the principle of the Roman hypocausts. The fresh air is heated by being passed over steam pipes of large diameter close to the boiler house, in which are three boilers for the supply of steam for heating.

Houses of Parliament.—This building is divided into two halves, the Lords' side and the Commons' side. In each case the fresh air enters by channels below the chief entrance, and proceeds thence, driven by a fan, to the cold air chamber under the House. From the cold air chamber the air is supplied either (1) to the hot air chamber, or (2) to the mixing chamber, and from the latter the air, regulated to the desired temperature, passes into the House by openings in the risers of steps carrying seats. It ascends

then to the ceiling and passes by openings round the glass light to the roof space, from which it is drawn by three channels at the angles of the House, and is driven out by another fan emerging in the court at the rear of the main building. The Committee rooms (six in number) are on the Commons' side of the building, and are ventilated in a similar manner, the supply and exhaust being worked from the fans on the Commons' side, which are accordingly of greater size than those on the Lords' side. There are for the Lords' half of the building one injector and one extractor fan, these being each 5 feet 6 inches diameter, and for the Commons' side one injector and one extractor, each 6 feet 6 inches diameter. Each of the six Committee rooms has a separate heating chamber, and there are also two on each side for supplying warm air to the floors and corridors. The fresh air is forced to all these chambers by the fans before mentioned. The business offices have natural ventilation only, the fresh air being supplied from the basement to the several rooms through wall flues, and flowing through the room passes out by other wall flues to the roof space, where it is collected in wood channels lined with zinc, and either emerges directly above the roof, or, if the loss of temperature is too great to admit of sufficient natural power for this, the foul air is allowed to descend again to the basement, and being warmed by a coil of steam pipe ascends once more to the roof and flows out. The incoming fresh air for these offices can be heated either by a coil of steam pipe in the basement or by a coil in the room, or, if it is desired to rapidly raise the temperature, the supply of fresh air can be shut off and the atmosphere of the room only heated by circulation around the steam coil in the apartment. The glass ceiling lights over the Houses and elsewhere throughout the building in every case have steam pipes in the space above them, to prevent the internal air becoming chilled and descending in a draught on those below. The floors of central hall and assembly rooms are paved with marble and have a hollow space below, by which means they are heated with steam pipes, the air flowing underneath the floor over the steam pipes into the halls by openings in wall canals. The floor of the Vestibule has a similar arrangement, but the heated air enters by gratings in the floor.

University Building.—This is an especially interesting application by Professor Böhm of a modification of his original system. The buildings are, for the purpose of the ventilation scheme, divided by a central axis. The fresh air is drawn from a large shaft in the great courtyard and driven by two fans, 10 ft. 6 in. diameter, worked by an 18 horse-power engine. There is also a third intake channel for natural ventilation when the fans are not working. The fresh air drawn from the shaft proceeds by a grand channel running all round the buildings under the corridors, and is admitted thence into the heating chambers containing coils of steam pipes, one of which is provided for every lecture room. The supply of fresh air to each class-room is thus regulated. An outer flap next the main trunk canal is opened by the machinist during the hours when any particular class-room is in use, while a second flap is raised or lowered at the pleasure of the professor from the lecture room, thus determining the amount of the incoming fresh air, its temperature being regulated by a third flap, by which the whole of the fresh air or any part of it can be directed through the heating chamber containing the steam coils. There is no exhaust fan, but the foul air goes out through flues in the walls and emerges above the roof. The openings to these flues can be regulated by louvre shutters. The inlets and outlets are arranged as already described, so that the fresh air enters at the ceiling level in winter and floor level in summer, and passes out at the floor level in winter and the ceiling level in summer. For the smaller rooms the heating is either (1) by steam pipes arranged in Böhm's calorifers; or (2) by stoves of the ordinary German type. The calorifers and stoves are enclosed in casings or mantels, fresh air is admitted to each direct by a channel from the external atmosphere at the bottom of the mantel, and flows out at the top after being heated. The exits for the foul air are provided by wall flues. With Böhm's calorifers the rooms can be heated either by the fresh air passing through the calorifer, or by closing the fresh air inlet and allowing the atmosphere of the room to circulate through the calorifer, the latter method being adopted when it is desired to rapidly raise the temperature of the apartment. The corridors and staircases are heated by coils of steam pipes enclosed with an ornamental metal casing.

Fine Art Museum and Natural History Museum.—These twin museums offer another interesting variation of Professor Dr. Böhm's system, the main point of the new departure being the use of a low pressure hot water system of heating. There are in each Museum two boiler houses, each containing four boilers, so that the building can be heated from one boiler or two in each part. The water being warmed rises directly to the main supply tube in the roof space, whence it flows by a number of vertical pipes

each forming a coil in a stove cylinder in each floor, and thence passing away down to the basement and collecting in a main return pipe, flows again into the boiler. Expansion of the water is provided for by an open cistern in the roof. All the pipes are hung so as to be free to move with expansion in the direction of their length, whether horizontally or vertically, the compensation for the variation being provided for by copper feathering in the pipes. The heating being thus effected by hot water, and not by steam as in other instances, the fans for ventilation are driven by gas engines of 6 horse-power each, each of which works one injector and one exhaust fan. Each Museum has four injector and four exhaust fans, all 4 ft. 6 in. diameter, and capable of a maximum speed of 120 turns a minute. Vertical wall canals in the cross walls bring the fresh air from the basement to the inlets, which are formed in the archway between the rooms, the outlets being at a distance of three rooms from the inlets, and communicating with foul air canals leading down to the basement and the exhaust fans. No provision is made for warming the fresh air for the Natural History Museum, it being contemplated to use the artificial ventilation only in the summer. In the Fine Art Museum the fresh air is heated by high pressure hot water coils, each furnace and each heating chamber being arranged in two divisions, so that the temperature of the in-flowing air can be regulated by the employment of half or the whole of the furnace power with half or the whole of the coils. The Picture Galleries, instead of the coils occupying the corners of the rooms as in ordinary cases, have warm water gill stoves in the centre of the gallery, of circular or elliptical form, cased in and with seats arranged around them. The circular stoves have a heating surface of about 500 square feet and the elliptical stoves of about 600 to 750 square feet. The Vestibules of both Museums are heated by the circulation of warm air heated by a gill stove in the basement and falling again when cooled.

Jewish Hospital, Währing. One of the earliest of Professor Dr. Böhm's introductions of ventilation I saw at this institution. Several means for producing a satisfactory result are combined in this instance. In the first place the ventilation can be obtained either by natural or artificially induced currents. Each large ward has (1) 3 wall flues or "roof canals" (Dach canäle) which run up from the basement to the roof space, connect and pass through the roof to the open air. Each flue has in the room two openings, one at ceiling level and one at floor level, either or both of which can be closed by louvre shutters; (2) wall flues at the sides of each window with openings to the wards both above and below the window, the lower opening being also connected with the external air through the window parapet; (3) an enclosed calorifer which can be supplied with fresh air, either from the external atmosphere or from the ward. Thus fresh air can be admitted to the ward either by the openings, by the windows, or by the calorifer, &c.; the foul air can pass away either to the roof by the "roof canals," or can be drawn down by these flues to the basement and then expelled by means of the fan, 4 feet diameter. The windows can also be opened, and the fanlights of the sashes are arranged with reciprocal motion.

Schools.—The success which has attended Professor Dr. Böhm's treatment of ventilation, and the monopoly which he has obtained of all the most important opportunities, rendered it difficult to find other examples of different methods, but I was able to see the system adopted in the Town Schools, and arranged by Herr Baurath Paul, which has been found very efficient, and is far less costly than are the monumental schemes of Professor Böhm. Herr Paul uses only natural ventilation in summer, the fresh air being admitted through the window parapets in an upward current, and the foul air passing out by flues in the wall through openings near the ceiling level. In winter this exit is closed, and another at the bottom of the same flue and near the floor level opened. The summer inlets are also closed, and fresh warm air admitted by a flue from the basement after being heated by Paul's calorifer. The inlet is about 6 or 7 feet from the floor. Each class-room has its own supply flue, and also has a thermometer hung on an endless line and running in a chase down to the basement, so that the attendant at the furnace can at any time see the temperature of the room and regulate accordingly the supply of heated air. The thermometers are in reading compensated for loss of heat in descending to the basement.

Barracks.—From Herr v. Grüber I learned the system of ventilation adopted in the military barracks—a simple adaptation of natural means. The fresh air is brought from the external atmosphere by channels in the floor to the stove, and on entering is warmed thereby. The foul air passes out by a wall flue above the roof, the flue having two inlets in the room, one near the ceiling for summer use, and the other at the lower end of the flue near the floor for winter. The prison cells are heated by warm air from a calorifer, each calorifer supplying four cells.

Herr v. Grüber has also adopted a similar system of ventilation at the Rudolfiner Haus, a pay

hospital, in the suburb of Unter Döbling. The fresh air is brought as above described by a floor channel to the stove and there enters the room, and the foul air passes away by the wall flue, with two openings for winter and summer respectively. In this case the wall flue rises the whole height of building, and is open at the bottom end in the basement, as well as at the upper end above the roof.

House-Group.—In an important group of houses-in-flats, situated between the new Rath-haus and the University, a general system of heating and ventilation has been adopted. Each house in the group, of which there are six, has a boiler house to supply the whole of the flats. The heating is by low pressure steam pipes, the main supply tube running direct from the basement to the roof space, and thence descending to the various rooms and feeding coils to each stove. The fresh air is admitted through the stove enclosure, which is of marble slabs in an iron frame, and by a regulating valve, may be either hot or cold, or if only a small amount of heat is required the inlets are closed and the room warmed simply by radiation from the marble surface. The foul air passes out by wall flues leading above the roof, and with the usual two openings in the room.[30]

Building Construction.—The principal points worthy of notice in Viennese building construction result from the very stringent regulations of the Building Act, which insists upon all floors being fire-proof and all staircases of stone. The floors are hence all constructed of brick arching, carried on rolled iron joists placed from 4 feet to 6 feet apart. The brick arching is formed of bricks on edge, the bricks being laid lengthways along the arch. The arches are usually circular on plan, thus obviating the necessity for centering, a simple turning piece being used in an inclined position, and moved by the bricklayer after laying each course. The skewbacks to the arches are corbelled out and not cut back. The bricks in Vienna are of larger size than our own, 11½ inches by 5½ inches by 2½ inches; they are very absorbent, and the mortar is therefore always used in a liquid state and poured on to the work. Concrete is not used for arching or forming floors, as it is found that brick arches are cheaper and better understood by the ordinary workman.

The stone staircases are interesting in their apparent boldness. Except for straight flights the steps always radiate to one centre, although the form of the stair may be elliptical either on the longer or shorter axis. The steps are pinned 5½ inches (half-brick Viennese) only into the wall at one end, and are carried by mutual support.

At the new Palace for the Emperor, which is just above ground-level, I saw the method of forming foundations. These are not of concrete as we understand the term, but of large irregular masses of *nurstein*, a muschelkalk conglomerate, found in the immediate vicinity of Vienna, and which is packed with smaller pieces and grouted with hydraulic mortar to form a firm foundation. Here, too, many of the basement walls are built partly of rough limestone (*leitha*) and brick, in some cases in alternate courses of 12 inches or 15 inches stone to 9 inches brick, in others of brick casing with stone filling-in. This is done for the sake of cheapness, the stone being less costly than brick.

The whole of the drains below the buildings are constructed of granite, formed of two sections hollowed out from the solid, are elliptical in section, 2 feet 8 inches wide and 3 feet 8 inches high, internal dimensions. The joints are made in oil cement, and the fall is 7 in 1000. The drains external to the building leading to the main sewer in the street are brick, elliptical in section, 3 feet 10 inches wide and 6 feet 2 inches high.

Another striking feature of Viennese work is the general use of plaster for exterior wall surfaces, mouldings and decorations, and even figure work. It has, I imagine, resulted from the very inferior character of the local bricks, which has naturally led to the development of the plasterer's craft. The plaster is composed simply of white lime and Danube sand. The lime is usually slaked and kept in pits under water for a considerable time before using. The sand is for the first coat extremely coarse, being really shingle, nothing less than the size of peas being used; in succeeding coats the sand is gradually used

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[30] The very severe climatic conditions of Vienna must be remembered in considering the system of ventilation adopted. The average range of temperature is no less than 87° F., from 6° F. in winter to 93° F. in summer, a greater variation than Moscow, which has a mean range of 82°, while that of London is 57°. The most frequent winds in Vienna are West and North-west, these prevailing in the proportion of 25 and 20 per cent. of the whole year respectively. The average rainfall for a year is 22½ inches, the average hygrometrical degree for the year 73 per cent., ranging from monthly averages of 62·7 to 83·7 per cent.—F. R. F.

finer, and in the last coat is almost impalpable. The trade of the plasterer appears to be hereditary and traditional, the right proportions of the lime and sand being determined literally by rule of thumb, as the workman judges of its fitness by the appearance as it runs off his thumb or finger when dipped into it, no hard and fast rule being followed.

Hoop-iron bond does not appear to be used, but instead wrought iron ties are extensively employed under sills and across brick arches, also vertically at quoins and sides of openings. The joints are left accessible till completion, so that they may then be wedged up.

Hospital Planning.—I saw two interesting examples of hospital planning at the institution called "Rudolfiner Haus," at Unter Döbling. The existing hospital is a temporary barrack with two wards, one for male and the other for female patients, with waiting room, consulting room, operating room, bath room, water-closet, and a small kitchen, grouped in the centre. The building is of wood with iron framework, and is has light iron trusses to carry the roof. It is only one storey high, and is exclusively top lighted. The heating is by high pressure hot-water pipes running round the walls and coiled at the openings for ventilation, which are behind the beds. The foul air passes away by a simple upcast shaft, a coil of pipe being placed at the bottom to induce a current. The other example is the pay-hospital now being built in the same grounds, and consisting of a two-storey building and basement. The ventilation has been already described under that head. The roof of this building is very flat, and is formed in a manner not uncommon in Germany and Austria. On boarding, 1¾ inches thick, is laid a covering of roofing felt, and this is followed by a layer of holz-cement, finished with a top dressing of sand and shingle. Holz-cement is composed of clay, paraffin, lime and magnesia, in proportions kept secret by the maker.

Exhibition Buildings, Buda-Pesth.—I made a plan of the main building for this Exhibition which is chiefly interesting as an example of the light iron construction adopted by the architect, Herr Ulrich. The ironwork was designed and is being supplied by Schmidt and Hallama of Vienna. The whole of the ironwork is in the form of lattice girders and columns, the columns differ in section from those of the Vienna Exhibition, of which this is a faint reflex, in that whereas the plan of the Vienna examples was H, those here are ▭ thus removing the material as far as possible from the neutral axes and enabling the architect to carry the weight required, with 38 to 40 kilogrammes of iron per mètre, instead of 45 to 50 kilogrammes, which would be required under the old system. These columns were introduced by Herr Friedman, and are hence called Friedmansche Saüle.

Miscellaneous.—In conversation with the architects I met I gleaned a few items of information which may perhaps be interesting, as throwing light upon the life of our professional brethren in Vienna. As in England an architect need not necessarily in theory pass any examination before commencing practice, a brass plate and influence may start him on his career, but practically, he would find very little employment without being *diplomé*, and this he can only attain after five years study in the Technical High School. On leaving the Real Schule, a boy at the age of about sixteen enters the Technical High School, where the course of study is as follows :—

First year.—Mathematics ; geometrical drawing ; elements of pure mechanics in connection with graphic statics ; principles of architecture ; architectural drawing ; figure drawing.

Second year.—Technical mechanics ; general and technical physics ; practical geometry ; plan drawing ; architectural drawing ; figure drawing.

Third year.—Building materials and building construction ; history of ancient architecture ; design of ancient architecture ; architectural drawing and design ; drawing of ornament ; modelling.

Fourth year.—General knowledge of machinery ; architectural history of the middle ages and modern times ; architectural design in the middle ages and renaissance ; architectural drawing and design ; perspective ; drawing of ornament ; modelling.

Fifth year.—Principles of organic and inorganic chemistry ; geology of building stones ; mechanics of building ; principles of street and water works ; principles of bridge and railway work ; architectural drawing and design ; design of buildings for practical use ; design of railway buildings ; law of building and railways.

After leaving the Technical High School the student usually goes to the Academy of Fine Arts for a term not exceeding three years; he then goes as a journeyman on some building or in a builder's

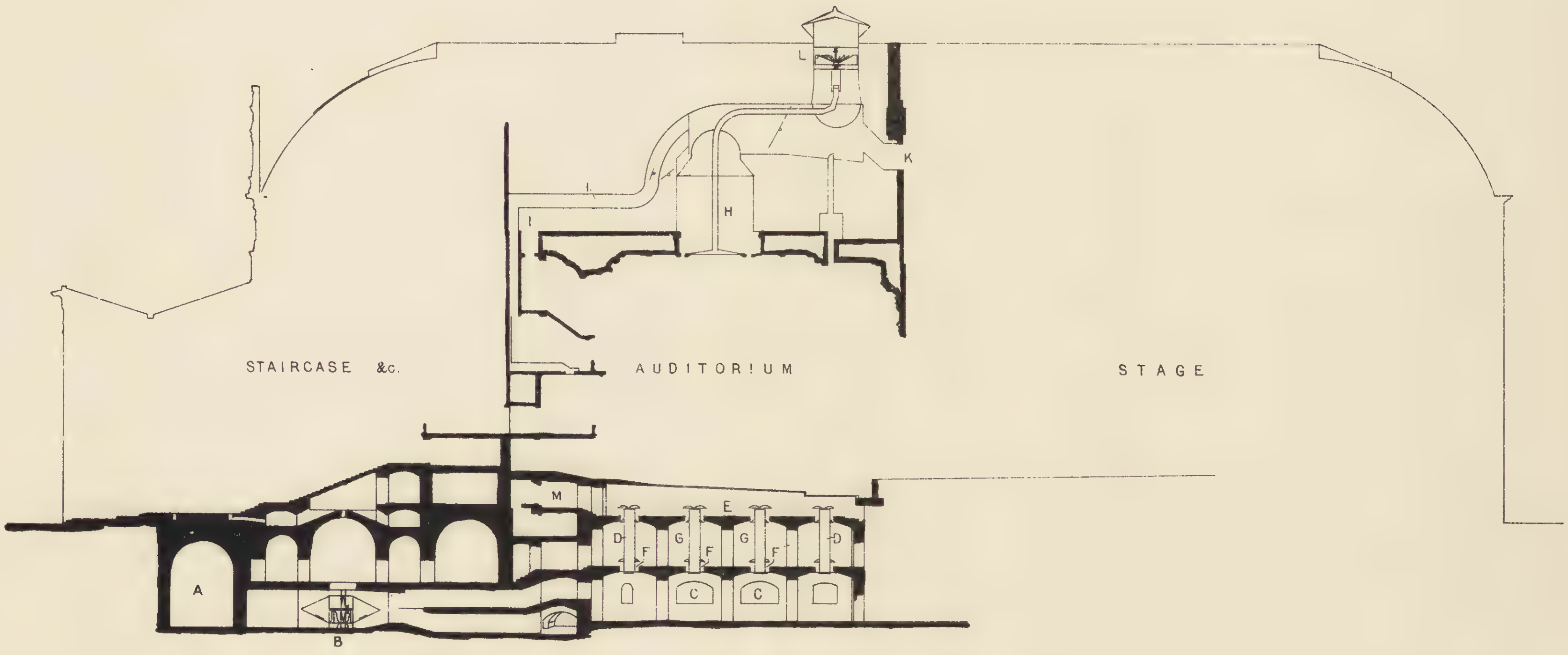
workshop, working as a mason, bricklayer, carpenter, &c., for the space of one year. After this he enters the office of an architect for usually three or four years before commencing practice, precedent to which also he spends at least one year in the army.

The payment of architects is always by commission, agreed upon at the commencement of the work, and varies from 2 per cent. upon plain simple buildings to 8 per cent. upon highly ornamental work.

Owing to the severity of the winter and the heavy snow-falls to which Vienna is subject, building operations are almost completely stopped during the months of November, December and January. In February crowds of peasant women come in from Bohemia and Moravia and perform the labours of the bricklayers and masons. The best stonemasons also immigrate from Italy.

FREDERIC R. FARROW.

SECTION SHOWING ARRANGEMENT OF VENTILATION.



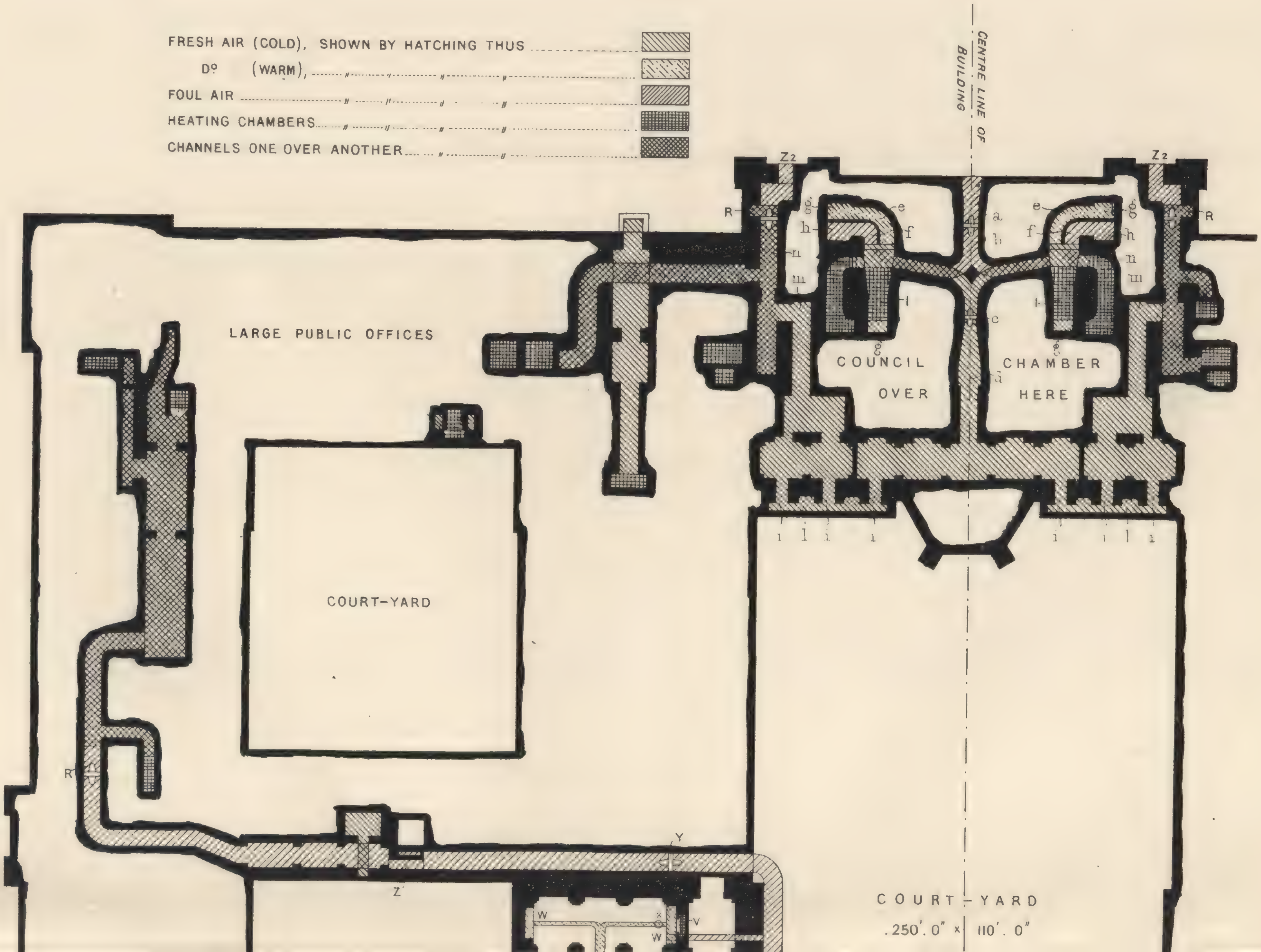
SCALE OF 10 0 10 20 30 40 50 60 70 80 90 100 ENGLISH FEET.

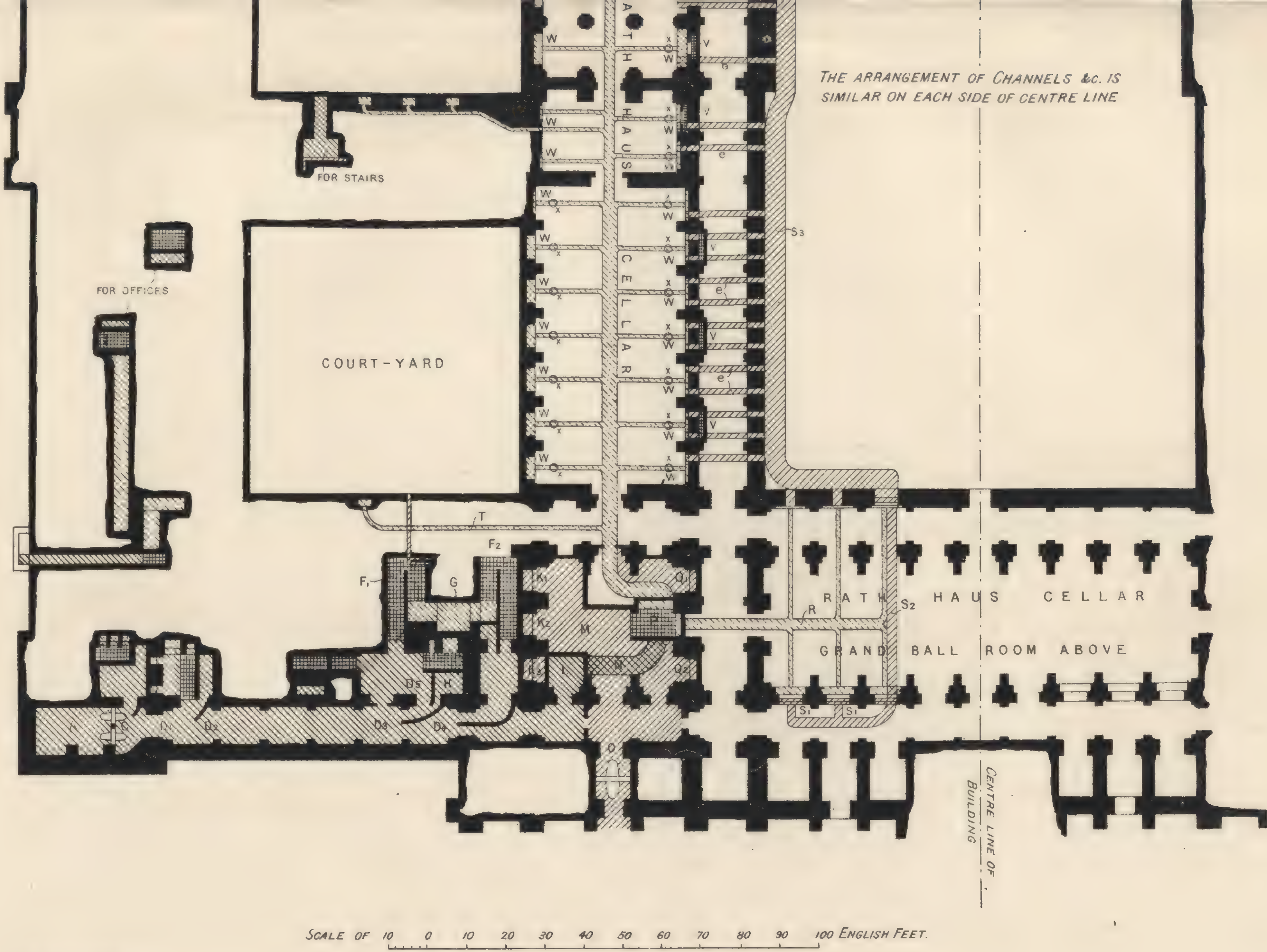
F.R.Farrow, del.

87. THE OPERA HOUSE, VIENNA.

C.F.Kell, Photo-Litho. Castle St. Holborn, London, E.C.

IV. THE GODWIN BURSARY; REPORT OF A VISIT TO VIENNA AND BUDA-PESTH (XIX).





F.R.Farrow, del.

88, VENTILATION AT THE RATH-HAUS. VIENNA: BASEMENT PLAN.

C.F.Kell, Photo-Litho.Castle St Holborn, London, E.C.

V.

THE FIRE-PROOF CLOSING OF OPENINGS UNDER THE METROPOLITAN BUILDING ACT. By William White, F.S.A., *Fellow*.

[Read on Monday, 19th January 1885, Ewan Christian, *President*, in the Chair.]

THE subject of Fire-proof construction is by no means new to this Institute. But I hope to invest it with some little fresh interest, both as to the building to be protected and as to the duties and the responsibilities of those who are supposed to be the true and proper exponents and guardians of this construction, namely, the Metropolitan Board of Works, the District Surveyor, and the Architect. Fresh circumstances will always continue to suggest new points for discussion. New inventions and new requirements will give rise to new modes of coping with difficulties which have to be overcome in meeting the increased risks which must from time to time arise, especially in the larger classes of buildings. But my chief purpose now is to call attention to the non-observance of existing restrictions.

Much has been done to obviate the risk of fire by means of so-called fire-proof construction, by which the area of the outbreak has been checked till such time as effective assistance may have arrived. Ordinarily, and if properly observed, the provisions of the Metropolitan Building Act, 1855, are sufficient for the protection of warehouses, which have been united under Section XXVIII.[31] But one of the most important of these

[31] The terms of the Act, in this particular Section, are—

1. No buildings shall be united unless they are wholly in the same occupation :
2. No buildings shall be united, if when so united they will, considered as one building only, be in contravention of any of the provisions of this Act :
3. No opening shall be made in any party wall dividing buildings, which, if taken together, would contain more than two hundred and sixteen thousand cubic feet, except under the following conditions :

   Such opening shall not exceed in width seven feet or in height eight feet :

   Such opening shall have the floor, jambs, and head formed of brick, stone, or iron, and be closed by two wrought iron doors, each one-fourth of an inch thick in the panel, at a distance from each other of the full thickness of the wall, *fitted to rebated frames*, without woodwork of any kind :
4. Whenever any buildings which have been united cease to be in the same occupation, any openings made in the party walls dividing the same shall be stopped up with brick or stone work of the full thickness of the wall itself, and properly bonded therewith.

provisions has been again and again set at naught in the adoption of sliding instead of rebated doors, and still continues to be so, often probably without a thought that a wrong against the public is being perpetrated, or an illegal act is being committed. It is this which I have undertaken to show to be the case. In doing so it will be necessary to enter a little into detail as to the manner in which fires are communicated from one building to another when their separation is not properly complete.

In all cases, of course, the very first, the most obvious and most important, aim must be directed to arresting the spread of the fire in its beginning. To this end a chief consideration will be the providing of incombustible and air-tight floors and doors. Obviously one dangerous source of conflagration is the skeleton framing of common joists and boarded floors, especially if these be not tongued. If a fire should arise from the ignition of window blinds, curtains, hangings, or flimsy wall-linings, the plaster of the ceilings above forms a material protection. But when, as is frequently the case, a fire commences in an accident from volatile oil, or gas, or from articles of furniture upon the floor, it is straightway fed by the jets of air which rise rapidly from the chinks between the floor-boards, and which conduct the fire down through the combustible boarding to the joists, whence it is carried up through the wooden partitions to the floor above. The same process applies to the doors and their chinks, and to lifts, ventilating flues, and staircases, which furnish ample means for the rush, whether of the cold stream of air which feeds, or of the hot blast which carries, the fire from one storey to another. But that to which I wish specially to call your attention is the avoidable danger arising from openings in party-walls formed to unite buildings of the warehouse class. These dangers are not always avoided as they ought to be, and they arise, as it seems to me, from a strange misconception in the interpretation of the Building Act. This misconception I wish to state with a view to its correction, for it has led to most disastrous results, in one instance at any rate, and probably in numerous others. The rapid lateral spread of fire from one to another of several buildings, which may have been united by means of openings made in the division walls, suggests the probability of sufficient precaution not having been taken for the prevention of it in the construction of the same. Had the separation been reasonably efficient, in the instance I now call to mind, the fire must have very quickly appeared bursting through the windows and combustible roofs, rather than spreading as it did through walls of solid brickwork, usually and properly provided in the construction of such property.

A brick wall is only comparatively and temporarily fire-proof. Its resistance depends upon the superficial extent, the degree and the continuance of the heat applied to it. But it has proved ordinarily sufficient when the resistance has not been neutralized or destroyed by improper openings. This resistance when presented, as it commonly is, by such walls in a lateral direction, must naturally be far greater than that presented by combustible horizontal floors and ceilings in a vertical direction. It is this which makes the efficient separation of large buildings a matter of vast importance. With a proper separation on either side, carried well above the roofs, an ordinary house may be, and often has been, burnt out without the fire being communicated to others on either side of

it. When therefore a fire spreads laterally, with great and unusual rapidity, the inevitable conclusion is that there must be some unusual defect in the resistance intended to be offered to it, some unusual risk attending the arrangements or the mode of construction. It is on this account that, on this occasion, I wish to deal only with this branch of the subject. The construction of the wall itself scarcely comes within its scope. At the same time I would urge that in all brickwork greater precautions ought to be taken to guard against the imperfect filling of the side joints. Air may be readily drawn or forced through an ordinary brick wall. Whether the blast be hot or cold the mischief is much the same, though its direction may be reversed. When the body of the wall is permeated with interstices, as is the case when the side joints of the bricks are imperfectly filled, the work can be done with much less expenditure of labour and less mortar, and the bricklayer is enabled to display a neatness of joint which can hardly be had with a sufficient filling of good mortar; but the result is miserably flimsy and unsound work. All this, however, is quite of secondary moment in the treatment of my subject, which relates to openings and their filling.

The subject divides itself into three distinct parts, namely (1), the material of the door; (2), its fitting; and (3), the arrangement of the opening. In considering each of these points separately it seems necessary to refer to the supposed defects of the provisions made by the Metropolitan Building Act, as well as the remarkable power of prevention when these provisions are understood and applied.

1. For the material of the door, iron still holds its own; it is not perhaps in all respects the best, but it is one of the safest materials against the application of force. There is danger in its liability to warp, twist, and melt, as well as to conduct and radiate heat on the side away from the fire, to a degree almost equal to that to which it is exposed. Concrete doors on iron wire lattice frames, as made by Mr. Brannon, would seem to be admirably suited for fire-proof purposes; their thickness would allow of a deep rebate, and being substantial, and non-conductors of heat, they obviate much danger. I do not know to what degree of heat they have been tested. There was an excellent fire-proof door at the Health Exhibition in some sort of concrete, but I do not remember the name of the maker. Even common deal may be made a non-conductor, secured from combustion by being completely encased in plaster or sheet-iron, and its resistance is very remarkable. In a casing of iron, this was admirably illustrated by specimens produced by Mr. Horace Jones in the Conference of Architects at the Health Exhibition. I believe that an equally sound, safe, fire-proof construction could be made by an oak door, double-planked, with a sheet of metal or asbestos between the two thicknesses of board. Though the outer board might be charred and almost consumed, the inner one would be scarcely affected by the fire. A solid oak door of 3-in. or 4-in. planks, without extraneous protection, is said to resist almost any fire, if its edges are well protected by a wood rebate. The charred surface forms a non-conductor excluding the air from the fibre within. The Cyanite, or Asbestos fire-proof paint on ordinary deal doors will afford great security, but I do not know if the degree of heat which this will bear has been sufficiently tested.

According to the terms of the Metropolitan Building Act, the door is to be made of wrought-iron; of which the panel is to be not less than ¼-inch thick. This therefore is commonly made of sheet-iron, on which is riveted a skeleton framing of similar thickness, dividing it into two or more panels. The danger of this construction arises from the probability of its warping or twisting out of its rebate under great heat, so as to let the fire, or a current of air, pass through the opening. It is found that this takes place chiefly in sudden and unequal cooling after intense heat. Supposing enough space to be left in the thickness of wall between two doors on either side of it, to prevent the second door becoming over-heated by mere radiation from the first, a fair amount of security is obtained. This is supposing the two doors to be fairly air-tight, though what their distance apart should be I am not prepared to say; but, I know that, in many serious cases of fire, the thickness of the wall provided by the Act has been found sufficient. It has, however, been well suggested that, in many cases at least, the wall should be thickened out in the formation of such openings. Certainly the danger arising from this special cause would be thereby much lessened. Whether iron be the best material, or not, it is at present the one required by the Act.

2. The Act requires that the iron doors shall be fitted to a rebated frame. In Sect. XXVIII. it is enacted that "no opening shall be made in any party-wall dividing "buildings which if taken together would contain more than two hundred and sixteen "thousand cubic feet, except under the following conditions:—Such opening shall not "exceed in width 7 feet, or in height 8 feet, such opening shall have the floor, jambs, "and head formed of brick, stone, or iron, and be closed by two wrought-iron doors, each "one-fourth of an inch thick in the panel, at a distance from each other of the full "thickness of the wall, fitted to rebated frames, without woodwork of any kind." In my innocence I used to think that this precaution was taken with the express view of making the said opening fire-proof by closing the doors. I am told however that the Act does not say so, and it is no good my supposing anything of the sort! The previous section, it is true, does say something about fire-proof party construction.

The doors shall be fitted to a rebated frame, to which, we may presume, although the Act does not say so, they are intended to be hung. The only purpose of the rebate is that no spaces shall be left around the edges. No draught shall pass through, and no heat except by conduction and radiation. The first effect of the heat of a fire upon the iron door will be to expand it, so as to fix it firmly in the frame, making it still more air-tight. I am told by Mr. Aston Webb that on two occasions of a fierce fire in the smutting room of a mill at Deptford, which was thoroughly burnt out, the ordinary iron doors fitted in this manner resisted effectually the communication of the fire to the adjoining division of the building, although in each case one of the doors was subsequently found to be warped out of its rebate; and the same was the case with the great fire at Paternoster Buildings, by which an enormous amount of property was saved. This warping no doubt took place in cooling when the greater part of the danger was past.

But when not under the requirements of the Act, when the most has to be made of available space, when no precautions are taken against the spread of fire, such doors are

hung in a totally different way. They are then suspended by wheels or pulleys, running on an iron bar above the opening. The door slides on to the face of the wall, and there is of necessity a considerable amount of play to enable it to move freely. Besides this, it is to be observed that, even supposing it to fit fairly, there can be but one line of contact, instead of two, as in the rebated frame. There is no confined surface around which the fire will have to pass; and there is no real check at all to the free passage of air, at the very lowest pressure, both at the top and sides. At the bottom the passage for air must necessarily be still more free. No amount of expansion by the heat will help to close the joints. Such a construction as this will not meet the requirements of the Act, any more than it would satisfy the demands of those who, on their own account, might wish to adopt a reasonable fire-proof construction. Such, however, was the description of the fitting of the doors which separated the different buildings of a warehouse which was lately destroyed by fire. The condition of some of the heads and jambs of the openings showed that the flames had played somewhat freely through the chinks upon the match-boarding. The doors were closed, or at least must be supposed to have been so, at the time of the fire. The watchman opens each door and closes it after him on each of his rounds. His circuit occupies two hours or more. Whether the doors were at the time open or closed, it is plain that the fire might easily be drawn through on the one hand, or be fed with air currents on the other. It is difficult to conceive how such a provision of such a special Act of Parliament should be set aside by anyone, still less by all together of those supposed to be specially interested in its observance, namely—the architect, the builder, the district surveyor, and the building owner. Even the Metropolitan Board itself is expressly forbidden by a special clause in the Act, at the end of Sect. LVI., to authorize such a deviation from its provisions. Hence it is all the more inconceivable how such an important detail should be merely overlooked, and escape notice; or, if wilfully executed, escape detection. It is of course quite conceivable that a warehouseman or tradesman might be ignorant of the provisions of an Act of Parliament, or even of the consequences of a small deviation in detail from those provisions, even if he were aware of them; and, whether wholly irresponsible, or fully insured, he might be induced to demand sliding doors instead of folding doors for his own convenience. The obstruction caused to his customers, and to his business, by the opening out of large doors into his warehouses, must be considerable, and we know how the trade is apt to kick at such restrictions.

3. And now I come to the third point. The facilities thus afforded for the spread of fire are sometimes largely and dangerously increased by the large and improper number of openings in each division wall. By means of these openings each storey becomes practically a huge horizontal warehouse, and moreover without any fire-proof separation in its height; and therefore with a succession of seven distinct risks, arising from the seven portions into which it is nominally and professedly separated. In this instance on each of the five storeys, in each party-wall dividing the several structures, were two such openings as I have described. Thus in each party-wall were ten openings instead of one. In the whole there were sixty doors, more or less—sixty distinct opportunities for

the accidental communication of fire, instead of six. Think what this means: sixty chances of imperfect fitting, of imperfect closing, of not being closed at all. Yet no one, officially or personally, is to be responsible for this state of things. It is not for me to express an opinion as to who might be considered to blame for a remarkable defiance of legislative enactment, over which nobody would appear to have any control whatever. I will merely state one or two of the views and suggestions which, from time to time, have been offered with reference to it. Thus I am told that, there being no penal or coercive means of enforcing the provisions of the Act, the owner is responsible for all his own acts on his own property. According to some the responsibility rests with him, seeing that he has the control, and that it can be presumably nobody's business, and to nobody's advantage but his own, if legal obligations are thus set aside. He must, moreover, be supposed to insure his own property, and to take advantage of any means which may present themselves of promoting his own trading interests, such as affording or facilitating free access to all parts of his establishment, which, however, may not be coincident with the interests of others. I am beyond measure astonished to be told that there really is, amongst district surveyors and others, a serious question as to the number of openings, of the sort described, to be allowed by the Act in any one such party-wall. I am told that most district surveyors take it for granted that there is no restriction whatever, and I shall be very glad to learn whether this be so or not. I know that some who have studied the Act very carefully are of the same opinion. I must, however, admit that I cannot insist upon this limitation. Authorities such as Gibbons and Hesketh, to whose comments I have been able to refer, clearly imply that none is intended. One authority would treat such party-walls as "cross-walls;" but that would be clearly inconsistent with the provisions of the Act.

Acts of Parliament are often loosely drawn, and can be made to show the grossest absurdities. It would be, indeed, an absurdity if this Act, in taking the greatest care to guard the public from the spread of fire, the tradesman from some of the accidental results of his own carelessness or of that of his *employés*, should permit such party-walls to be riddled with openings from bottom to top. If the number of openings be not limited to one only, this is the only other alternative. Some would endeavour to make out that there is a limitation in the total amount of such openings to one-half of the superficial area of the wall, but I can find in the Act no clause referring at all to this in any way. The only limitation to be found in the Act is that the opening shall not exceed 7 feet in breadth, or 8 feet in height, and to my mind the Act gives very plainly the limitation of one opening only in any one party-wall. It speaks not of "such opening or openings," but it speaks of "such opening." The plural is used in other parts of the Act, and in this section it is used, but only in connection with the plural of party-walls, in the case of any such openings being subsequently walled up, as we have already seen. It must be admitted that a single opening is not perfectly compatible with modern requirements in the occupation of large warehouses; and the Act of Parliament, not being compatible with modern requirements, must be ignored! Of course, the observance of one little Act of Parliament is a very small thing, as compared

with the observance of the best way of carrying on one's business. And this business cannot be carried on without ready means of communication on each floor between the various departments. It is, therefore, necessary to read the Act, not as literally, but as liberally as possible. And, speaking seriously, this is the kind of argument with which so serious a charge is met. I must say I do not see the force, or the fun, of reading an Act thus liberally, to the freedom of those whom it is framed to restrain, and to the detriment and assured injury of those members of the community whom it is intended to serve and protect. At the same time I must admit that this is only my own opinion; others may think very differently.

Of course, in the case of a Store for the housing of goods belonging to the public, the interests of the public are on a totally different footing to those of mere casual purchasers at the tradesmen's shops, work rooms, or store rooms beneath. And this only makes the injury done by an infringement of the Act all the more grievous. It would be commonly supposed that some one ought to be responsible for the direct and wilful infringement of an Act of Parliament, if the infringement be naturally such as to lead to a wrong upon ignorant and suffering people, and to the advantage of the wrong-doer. But in this case it appears to be otherwise. The Metropolitan Board of Works exercises the greatest control over the responsibilities of all who are brought into contact, or into collision, with this Act, but the Chairman of the Board thinks it beyond its province, or its power, to institute an inquiry into such a contravention of it. There is no one who would be entitled to take cognizance of it as a grievance. And it is a case which would scarcely come within the province of the public prosecutor. It is beyond the reach of the legal officers appointed for the carrying out of the law. The district surveyor is not personally responsible; he is only the local official of the central authority, and anything done by him is done by authority, and not by him as an individual.

But there is, if I am correctly informed, a yet greater grievance, a yet greater anomaly. District surveyors say that there are really no means of enforcing such provisions! No penalties are attached to their evasion. There is nothing to prevent the proper or improper occupation of premises thus improperly and insecurely constructed. No preventitive remedies can be brought to bear upon it. Magistrates would not give an order. If this be so, indeed, the statute becomes a farce—a ludicrous interlude in a grand comedy enacted by the solemn legislature of a great nation. But more than this. Magistrates are unable to discover in the Act any definition of what a warehouse is, or is not, and they will on no account venture, upon their own responsibility, to adjudge a shop to be a manufactory or a warehouse, even if used for the making up of carpets, curtains, or boots, and for the storing of them when made, or, apparently, if used for the storage of household furniture belonging to the public. They think that such a preposterous proposition could not be maintained as against the shopkeeper. It is only a branch of the shopkeeping business, and this must not be supposed to affect less important considerations; and there is apparently no possibility of applying the restrictions to the warehouse proper. No commission, no system of inspectors exists, as under the

Factory Acts. The Act merely speaks of a "building used," not as "hereafter to be "used," and so, apparently, the condition cannot come into operation till after the occupation of the building. The restriction will not apply till after the district surveyor has granted, if he can grant, and does grant, his certificate, and the owner, or the occupier, shall have become free to use the building in any way he may see fit. If this be so, indeed, it is a case for immediate legislation; if it be not so, it is a case for administrative reform. It may be that the defects pointed out, in this case, were done subsequently to the district surveyor's supervision. It would be well, however, if matters could be put on a safer footing for the protection of the public. I used innocently to think that Sect. XLII. to Sect. XLVIII. of the Act were amply sufficient. There would appear to be every requisite provision for the inspection, condemnation, and pulling down of work executed not in accordance with the Act. But the doors referred to in Sect. XXVIII. seem to be regarded as merely an immaterial finishing; and "Qui custodiet, custodes illos?" It is apparently nobody's business to put the law in motion.

None could or would complain of the strict and immediate enforcement of restrictions with respect to the storing of paraffin, gunpowder, or other dangerous articles. Yet, ordinarily, the loss of property by a mere commonplace fire is far greater that that caused by all these things put together; only the fire is not so rapid in its results as the more explosive substance. Yet no one will be found to grieve over the hardship which it must be for the maker or purveyor of such things to be kept at a respectful distance in the locality of his emporium.

In the case of improper dwellings being used as sleeping apartments, there is a special provision requiring the district surveyor to inspect, if he shall have reason to suspect, an infringement of the Act, and special powers of entrance are given him under penalty. Whether he may be the best policeman for the purpose or not—and I do not quite think he is—there ought to be at least an equal power, if not compulsion, of inspection, to examine whether other provisions of the Act, particularly those relating to fires, are or are not complied with in the use and occupation of any building not used as a dwelling. I am quite prepared to be sat upon, to be told that I am all wrong, and behind the spirit of the age. I must admit the case is not without its difficulties, but I shall not cease to urge that, if the requirements of the Act cannot be carried out without undue interference with the commercial interests of this great metropolis, the Act should be repealed. But let not those who are concerned in maintaining the rights of the people as against the trading monopolist, and in upholding the law so long as it remains law, continue to shut their eyes to so crying a wrong as that which I have brought before you.

WILLIAM WHITE, F.S.A.

VI.

ARCHITECTURAL DRAWING. By MAURICE B. ADAMS, *Associate.*

[Read on Monday, 2nd February 1885, Ewan Christian, *President,* in the Chair].

PERMIT me to say, by way of a preliminary remark, that in complying with the request of the Council of this Institute, to read a paper during the present session on Architectural Drawing, I quite appreciate the honour which is thus conveyed to me, and it gives me great pleasure to respond to the invitation. If it is an honour, however, to be singled out in this way to lecture on such a subject, it certainly is an occasion on which one needs to remember that skill in architectural drawing, and greatness of treatment in architecture, cannot either be taught or learned by talking about them. There is a quaint old French book on architecture by Philibert Delorme which, in true if not stilted language, describes, with allegorical fancy, a beau ideal architect. He should have three eyes, one for the observation of things divine, and the works of God; the second for the careful observation of matters of every-day practice; and the third for looking into the future. He should have four ears, it being his duty rather to listen than to speak; and he should possess four hands, for ready draughtsmanship and quick execution, while his feet, shod like Mercury's, should be furnished with wings for rapid action. The sum of this description resolves itself into the saying, that "actual work is better than words, and the example of practice is of more infinite "worth than the theories of precept." Therefore acting on this idea, and assisted by the generous co-operation of several friends and collectors, I have brought together for the present exhibition a rather comprehensive series of many typical and historically interesting examples of architectural sketching and drawing, commencing with some remarkable specimens by Inigo Jones, lent me from the Royal Library at Windsor, by special permission of Her Majesty the Queen, and some others equally valuable, contributed by His Grace the Duke of Devonshire. The series[32] starting with these includes most of the leading names of Englishmen whose drawings characteristically illustrate the subject of my paper from the seventeenth century down to the present time. It would perhaps be invidious to single out any individual contributor for special thanks when all have been so kind, unless it be Mr. Ruskin, because he has lent some of the

[32] A list of the several contributors and the names of the artists, with the titles of their works exhibited, is given on pp. 89-92.

most subtle and remarkable of the specimens exhibited [Illustns. xxx-xxxii],[33] and while thus expressing our indebtedness to him I am sure we also desire to convey with equal emphasis our sincere acknowledgments to everyone who has in this way kindly co-operated with us on the present occasion. In the course of my remarks I hope to be able to refer to some of the drawings in their chronological sequence, but with so numerous a collection it would hardly be possible to notice each of them in particular. My object in selecting these specimens of work is to place side by side some of the best architectural drawings ever produced by students in the English school, workers in the more recent successive phases or revivals of all the styles, but each, according to his share of ability, exhibiting with more or less force the catholic strength of true art, the simple poetry of beauty, and the exquisite achievements of unaffected labour.

We have, therefore, a very practical lesson at once placed before us, such as few essays, descriptive or otherwise, could possibly give, and the aim of my paper will be rather to suggest matter for discussion than to attempt an elaborate treatise on the subject. For reference sake, on entering on this question, it may be of service to allude to the Paper on Architectural Drawing[34] by the late William Burges, A.R.A., and also to a lecture under the same heading by Mr. R. Phené Spiers, F.S.A., delivered in 1874 before the Architectural Association. Mr. Burges, with an ardent love and masterly knowledge of mediæval architecture, the 13th-century phase of which he always taught us, by his works as well as with his lips, to admire, described certain characteristic and valuable examples of drawing left us from the Middle Ages, advocating, as consequent upon the progress of the Gothic Revival, the use of a similar style of bold outlining such as his instances illustrated, and which in his own drawings he had so very charmingly adopted. Besides this he urged, with greater, because more natural, force, the necessity of learning to delineate the figure and other animal forms and outlines. Mr. Spiers, equally devoted to his art, claimed for the modern French system of shadows and tintings many advantages; as a most successful student from Paris, and of course as an authority of considerable experience at home, the opinion of Mr. Spiers on this subject will always command the attention which it certainly deserves. For my own part I may make bold to confess a decided preference for the individual character and personal freshness peculiar to English drawings; and admirable as the French scheme of art education is I should be very sorry to see it adopted literally in this country. With all the failings of our pupil system, and consequently perhaps want of systematic modes of study, there can be no question, I think, that architectural education and draughtsmanship have made amongst us, during the last few years, a very remarkable progress, while probably there

[33] Mr. Ruskin was good enough to consent to the publication of all his drawings exhibited at the Institute, but from the fact of their being partially coloured and executed on tinted paper, in a mixed material, it was found impossible to reproduce them; and it is only fair to state that the two which are here published fall far short of the beauty of the originals.

[34] See the TRANSACTIONS, 1860-61, page 15. Other papers on this subject are one by H. B. Garling, *Fellow*, in the TRANSACTIONS, 1858-59, page 13; one by the late Arthur Ashpitel, *Vice-President*, in the TRANSACTIONS, 1861-62, page 193; and two by Professor Donaldson, *Past-President*, in the TRANSACTIONS, 1863-64, page 121, and 1869-70, page 110. Mr. Maurice B. Adams read a paper on the same subject before the Architectural Association in 1877, which was reported in the professional journals.

never were more men able to draw well than there are at the present time, even after making due allowance for the enormous increase in the ranks of our profession.

Architectural drawings are too technical in their nature ever to acquire a popular character in any sense the same as pictures or sculptures, and as an evidence of this we need scarcely to be reminded of the cursory way in which the ordinary visitor to the Royal Academy glances at the gallery where architecture has been permitted, with scant courtesy, to enjoy a limited space, in company with etchings, engravings and miniatures. There is, however, a very considerably increased and wide-spread interest now taken in architecture, as well as in the higher forms of architectural delineation; and it is not merely because the painters want the present space at the Royal Academy that a new gallery for architectural drawings is being erected at Burlington House. The various sketching clubs and classes, the travelling studentships, the competition prizes awarded year by year, the illustrations and vast number of drawings published by our professional press, and perhaps, above all, the example of such men and masters as those whose drawings are here exhibited to-day, have combined in one way and another to produce the evident improvement to which I refer. The increased struggle of modern daily competition, too, should be accorded its proportionate share in the work of progress; but with this allowance, and as a serious set-off against it, we have to note the scamping piece-work or hurry-scurry undertakings done under pressure, as well as the mountebank performances of the acrobatic draughtsman or designer, who, in order to attract a notoriety, sinks to employ startling methods on the one hand, or affects the conventionalities of an antiquarian crudeness on the other. Of such as these, Mr. Ruskin writes with pungent terseness:—"Fed on the dusty picturesque of rags and decay, talk to him of the principles "of beauty, and make him draw what you will, and like the snail he will leave the "slime of himself on all he touches." A mean man will draw meanly, just as a superficial man will study carelessly; and as there is a mean way of drawing a noble subject, so there is a grand one. A great draughtsman will draw a poor object grandly, while a mean hand will render contemptible any subject that it touches; and this, be art education what it may, is inevitable. He who can draw well, largely, and simply, with a quick sympathetic touch and firm line, is much more likely to be a good designer and a good architect than he who shirks his drawing, fudges his detail, and, in a word, is unable to draw properly. Drawing, of course, to an architect is, and must always be, only a means to an end, and the better the draughtsman, depend upon it the more keenly will he realize how very far short his ability with the pencil fails him to adequately depict the ideal which his higher capacities aimed at or conceived. Instances can be quoted, I know, to prove that all great architects are not, and have not been, the most accomplished draughtsmen; but it is also to be remarked that such exceptions are, comparatively speaking, rare, and therefore, I take it, prove the rule. In the practice of architecture, as, indeed, in all other walks of life, there are so many qualifications which are necessary to make a man even fairly successful, not to say eminent. Remembering this, and without really for a moment wishing to argue that "there is nothing like "leather," by assuming that drawing is the chiefest qualification necessary for an architect,

I do most certainly assert that it is of paramount importance to him—for by what other means can he learn his art, or give expression to his designs? Such a simple and paradoxical assertion, on the face of it, may seem as uncalled for as perhaps it may appear unnecessary; but this is not so, seeing that it has become of late, in some quarters, the "shibboleth" of a would-be advanced art party on the one hand, and the gospel of a so-called scientific clique on the other, to decry good drawing, and to discredit it. So tangible a form has this negative view assumed to itself, that individual instances are boldly named as an evidence of its truthfulness. For example, a well-known member of this Institute, and one who has erected more buildings of a kind in London than any other living architect, said to me the other day that one palpable reason why the Royal Courts of Justice are, in his opinion, such a shocking failure, is that Street was so splendid a draughtsman. "Architectural drawing," he said, "is all very well, and certainly "never was so good as it is now, consequently there never was such a mixed medley of "miserable architecture." Accomplished draughtsmanship is, therefore, according to the sentiments of this authority, at best but a questionable advantage, and good sketching after all is only a doubtful blessing. In the face of such negatory criticisms there surely is some need of a protest, and perhaps no more opportune or effectual answer could be offered against such, what I may call "too utterly intense," theories than the representative works which are here exhibited to-night, including such names as Inigo Jones, Wren, Pugin, Barry, Cockerell, Street, and Burges, among those practical architects who have gone before, and the names of Ruskin, Nesfield, Norman Shaw, E. W. Godwin, and Ernest George, not to instance many others who still, like these, fortunately remain with us. Sir Edmund Beckett, who has been described elsewhere as "our only British "architect," the author of *The Book on Building*, and the designer of St. Alban's Rectory, as well as the new west front of that Abbey, once told me that he was not much of a "drawer" himself. This authority writes letters to *The Times* on the failings generally of architects, and he is supposed to lead public opinion rightly in this respect. "Architects are all very well to make pretty drawings," they say, "but only those "who step in where angels fear to tread ever venture upon the ruinous task of realizing "architect's pictures in bricks and mortar, for such an attempt must lead to failure "and a simple waste of money." I was once preparing some full-sized details for a carpenter, who was standing by my side waiting for them. "Ah, Sir," said he, "drawin' "is a werry pretty trade—a werry pretty trade." Thus Sir Edmund Beckett, Q.C., and old Peters the carpenter, re-echo, according to their measure, what goes by the name of public opinion; whether as individuals they are the most competent judges of these matters in the world, or not, need not now concern us. "Verily they have "their reward." The question which as practical men we must answer, however, is this: Is their criticism true? In a general sense of course it is not. Architecture is not a pretty trade, and architects are not merely Sir Edmund's poor paltry "drawers," but are we quite certain that our critics are so entirely wrong as some people in the profession would suppose? So long undoubtedly as architects differ like the stars in the heavens from one another in glory, whether they are garnished with a diploma or not, so

long will there be architects and architects just the same as there are critics and critics. Half the troubles of the architect are due to careless drawings, and many of the complaints against individual members of the profession, which one hears of, are attributable to the slipshod way in which details are prepared. The only answer worth anything with which to silence those who taunt us with simply pretty draughtsmanship must be found no doubt in the undeniable evidence of the thoroughness of our everyday practice, but, while thus emphasizing the importance of practical thoroughness, in our anxiety to become what is known as "good all round men," it seems to me more than ever desirable, in this essentially commercial age of push and steam, to take particular care lest we allow the science of building to crush out the higher and nobler spirit which constitutes the life and character of our Art. The subject immediately before us is so closely allied with that of architectural education generally that one can scarcely avoid a passing reference to the larger question. The Institute has, I fear, hitherto devoted much of its warmest thought in cultivating and protecting the eminently respectable practitioner; but if we are to preserve what remains to us of the more refined and artistic branches of architectural work, we must remember how tender a culture it requires, how much in these over-burdened times it needs educating, and how utterly impossible its healthy growth becomes in the confined atmosphere of an exclusive self-complacency. We have tried to bolster up worn-out antiquarianisms long enough, and they have proved at best but cloaks which ill befit the energies of those who have to deal with the present and prepare for the future. It is only a harking backward to cast a slur on painstaking truthfulness, especially in drawing, than which for the purposes of an architect there is nothing more essential, so that he may show with the utmost exactness and clearness what he wishes to see equally well executed, for without a facility of draughtsmanship how is it possible for him to convey his ideas to the workman? Of course the taste and intuitive skill necessary to delineate with feeling and accuracy of line, coupled with rightness of perspective, are all qualities of natural perception, to say nothing of artistic grace, harmony of colour and proportion, or the gift of imaginative design. These are beyond the powers of tuition or science to bestow; indeed, they are God-given faculties, possessed only by the few, and are such as none can afford to undervalue or despise. However painful mere laborious commonplace accuracy may be, it is unquestionably preferable to a reckless impropriety of expression or untrue intention aiming at imposing on others, and which, in order to accomplish its ends, rejoices in the trickiness of what is called the "getting up" of drawings. For an assistant or a draughtsman I would rather have the poor fellow once known to me, who, in his endeavour to draw correctly, carefully traced a blot on the drawing he had to copy, than the "awfully clever" type of cockney artist who can do nothing in a reasonable way for fear of being what he calls "commonplace." In this, as in all other matters, our desire should be to let common sense dictate, and if, as I have already said, drawing for the architect is only at best but a means to an end, we must, if we aim at good architecture, have correspondingly able and sympathetic draughtsmanship. To secure this we must avoid thoughtless "scrabbiness" of conventionality, at once so meaningless

and devoid of character, and we must learn to draw good pure forms with a humble faithfulness, inspired by spirited feeling, and rendered life-like by what is called the touch of "go." To the student I would say—Do not shirk the sculptured ornament or figure, and properly space out and draw the foliage, measure accurately the leading parts as well as show the jointings, and in order that the relative value of scale and proportion may be realized and understood, make general perspective sketches, if only as key references, and do not, above all, attempt too much. Draw correctly, lest while you deceive others you deceive yourself also, and remember the wants of the age in which we live. If good taste cannot be taught, much may be of course acquired to improve it, and in adopting a style do not hesitate to follow the lead of some acknowledged master, though it would be unwise to imitate the peculiarities of his manner adopted late in life, but rather select his earlier studies as a guide. And this for two reasons: first, by taking a great man's former sketches you study the stages of method by which he arrived at his ultimate efficiency, learning his style in its more elementary forms, and therefore nearer to your own starting point; and, secondly, you acquire a degree of strength in your own work before you become trammeled by the special mannerisms peculiar to the developed studies of your master, thereby leaving you free to acquire a specialty of your own. No man has been copied more than Mr. Street, and yet by how few successfully, simply because a jump was attempted at his conclusions, in an effort to adopt the dash of his matured hand, forgetting quite how long practice had won for him his cunning, and ignoring completely that absolutely good drawing was the subtle secret of much of his success, as well as the leading beauty of his versatile designs. Mr. Street's chief lesson was and is *good honest hard work*, and this is the point emphasized by the collection of drawings grouped here to-day. Most of them, mark you, were the private studies of the men who drew them, and not drawn as pictures merely, but simply to record and impress on the mind the architecture thus delineated, while in those which were made to give pleasure to others note how well their work is done. It matters but little after all what style you choose, and whether you draw in pen and ink, with the pencil or the brush, provided you are in sympathy with your work, actuated by love of it, and determined to do it well. These suggestions are so exceedingly elementary that they need an apology, I fear, but to be practical, whether as students or as working architects, we must needs strike at the root of the matter. This will not be accomplished by decrying skill in anything, especially in drawing, for we know that all architects cannot really draw, which, forsooth, is a hard saying, the sting of which lies in its truth, and while such inabilities exist good architecture may well be rare. I have more than once seen fully decorated architects who were so unskilled in the rudiments of perspective that they were obliged to sketch picturesque old English domestic buildings, which depend entirely on the grouping of their outlines, in eighth-scale elevation, quite missing of course the spirit of the whole thing. To this it may be urged that possibly Ictinus of Athens was not the most efficient draughtsman, and that perhaps Dinocrates would not have been able to pass a second-grade examination in perspective at South Kensington; but in reply to such a questioner I would remind him that we neither live in Ancient Greece nor Rome. The conditions

which govern our art and the purposes for which we build are now so different, while, as our architecture necessarily relies on its sky-line and general massing of parts for effect, if ever it is again to become a living indigenous art as it once was, our buildings and designs must be studied not only in dimensioned detail but in graphic perspective outline. It is the fashion now, also, with many younger men to cultivate a sort of affected careless mannerism in their drawings which should be unhesitatingly condemned, and the sum of my remarks is that architects cannot draw too well for the purposes of their art, provided it always be remembered that the object of an architect's work is the erection of buildings, and not merely the elaboration of drawings of them.

Our sketches and measured studies of old work are made with the object of storing the mind with knowledge and cultivating the taste. Our preliminary drawings of designs prepared for our clients are for the purpose of illustrating our proposals in the best and most easily understood form, and our working plans and contract details show actually, to precise scale, the designs determined upon for execution. The other remaining kind of architectural drawing yet to be named is that which includes the more advanced and elaborated studies made for exhibition, or for the illustration in perspective either of ancient or modern buildings, schemes for decoration and details of ornamental design. Each of these divisions is as necessary to accomplished work as the other, and no good architect can afford to neglect either of them. Some will of course excel in one form of drawing rather than another, and by the nature of things comparatively few will possibly acquire a proficiency in the last-named or higher styles of delineation ; but to one and all remains the importance, not only of drawing well, but thoroughly.

Turning now briefly to the exhibited examples we may profitably note some few particulars. Burges, after describing his specimens of mediæval drawing, alluded to others of later date among the Cottonian Collection in the British Museum, and notably one of King's College Chapel, Cambridge. But this, one of the latest to which he referred, although archæologically very interesting, is a comparatively poor performance, tinted in pale gray, poor in detail, and of but little architectural value. My series, as a continuation of the subject, begins with two remarkable drawings, executed (in my opinion) by Inigo Jones on vellum, and drawn in perspective, about the year 1618. They are two[35] of the three original drawings submitted to King James I. for the Royal Palace at Whitehall, and they now belong to the collection of drawings preserved in the Royal Library at Windsor Castle, so that they may truly be described as national in their degree of interest. They are executed in clear but faint Indian ink lines, delineated with exquisite delicacy, and washed in soft grey tints of subdued and softened excellence. Their perspective is certainly not above criticism, and the drawing of the arches in the façades is too pinched in its proportions, thereby giving to the design a contracted effect, with too pronounced a prominence to the vertical lines of the design, which clearly is out of accord with its style of architecture, and which is by no means warranted by the actual proportions as shown by the geometrical elevations. Nevertheless for perspective drawings

[35] Illustrated in *The Building News* for December 19, 1884, from the author's copies of these originals. Other drawings by Inigo Jones are at Worcester College, Oxford.—M.B.A.

they are unquestionably remarkable in many ways, and their existence has been but very little known. The other view, showing the Park front, is elaborated with shaped cut yews and shrubs in Dutch fashion. Lord Burlington, assisted by Kent, made a large collection of Jones's drawings, and these now belong to the Duke of Devonshire, who has graciously allowed me to make a selection for our present exhibition. These are most valuable, because they show how thoroughly well Inigo Jones had mastered the use of his pen in drawing Renaissance detail. Note more particularly the sheet of capitals, and compare them with Flitcroft's reproductions of the original drawings of the Whitehall Palace design which he made for Kent's book, published in 1727, by the plates of which Jones's designs are chiefly known to us. The original volume of these autograph drawings by Flitcroft is here exhibited by the side of Jones's own perspectives: the comparison at once furnishes a most interesting study, and besides these I show a large-scale elevation of the same design, drawn possibly a hundred years ago. In reference to Whitehall I am also able to exhibit one of the most recent instances of fine draughtsmanship, which cannot fail to secure your attention, viz. Messrs. Leeming and Leeming's Whitehall façade of their selected design for the new Admiralty and War Offices.

Inigo Jones, you know, added a portico to old St. Paul's, and of this I am able to show you his original design, which is most curious, and to be noted for the dashing drawing of the figure. There is also a reference too with regard to this drawing which may here be made, calling your attention to Raphael's study for his design for the church of S. Lorenzo, Florence, of which I show a photograph. The similarity of the style of the two details is rather striking. Besides Jones's portico there are some of his free and fanciful conceptions designed for the Court revels, of which he was the official master. In these, as in the other drawings by his hand, there is evidence of considerable power and freedom of design, a quaintness and spirited conceit, combined with a reserved technical character, well worth observing. Indeed Jones was a master, and the motto which he wrote in his Sketch-book[36] is characteristic of the man:—*Altro diletto che imparar non trovo.* John Thorpe's celebrated drawings[37] in the same collection, executed between 1560 and 1590, are far too important not to be mentioned here as early examples of the English Renaissance. They are drawn in brown ink lines with some crudeness, it is true, but clearly with a grasp of the spirit of the style which he originated in his designs. Contemporary with these drawings is the earliest known book in English on architecture, published in 1563. Of this work there is a copy in the Bodleian Library at Oxford, but the only one in London is fortunately in the Institute Library, for which I believe we are indebted to Mr. Wyatt Papworth. I refer to John Shute's *First and Chief Grovndes of Architecture.* Inigo Jones, be it remembered, was not born till ten years after the first edition of this unique book saw the light. While there was a living style of architecture, traditional in its details, workmen, unaided by drawings,

[36] Made by Inigo Jones in 1614. See *Archæologia*, vol. xxiv, p. 354, for a description, by the late Mr. J. Payne Collier, of the "attempted facsimile" of this Sketch-book, made at the expense of the sixth Duke of Devonshire, and presented by His Grace to the Society of Antiquaries, Sir John Soane and others.

[37] Several reproductions from these originals, and drawn by the author, were given in *The Building News* for January 25, February 8, and February 22, 1878, with descriptions.—M.B.A.

were possibly capable, under the direct supervision of the master-mason or architect, to carry out much of the work from only verbal instructions; the style was natural to the man, and he worked in it accordingly. With the withering influences of the Commonwealth art for the sword gave place, and architecture received a death-like chill, changing its living spirit quite, and rendering traditional skill almost entirely a dead letter. In the days of the Civil War there was but little building, so that when Sir Christopher Wren began his great career as an architect he found full-sized drawings an unquestionable necessity. Thus, writing to the authorities of Trinity College, Cambridge, in respect to the plans he had prepared for their new Library buildings, he says:—"I suppose "you have good masons: however I would willingly take a farther pains to give all the "mouldings in great: we are scrupulous in small matters; and you must pardon us, the "architects are as great pedants as critics or heralds." Of his power as a sketcher and draughtsman we have remaining to us many examples to bear witness. Most of them are at All Souls College, Oxford, and some are to be seen in Sir John Soane's Museum, comprising the Hampton Court and Greenwich Hospital series. They are chiefly drawn in brown ink and tinted with grey washes. From All Souls College I am enabled, by the courtesy of Sir William Anson, the Warden, to show you five typical examples, and among these observe particularly the view of Walter Chetwynd's house (Ingestrie Hall, Staffordshire), drawn somewhat after the manner of John Thorpe, but with figures in the foreground exceedingly well put in. Then there is a Mausoleum proposed to be erected for Charles I., at Windsor, and the original elevation of Bow Church tower and steeple in Cheapside. The other drawing is a full-sized detail of a swag and baluster, possibly for St. Paul's. Writing from France in 1665 he described himself as occupied in studying "the "most esteemed fabrics of Paris and the country round," adding enthusiastically, after a reference to certain "incomparable villas,"—"that I might not lose the impressions of "them, I shall bring you almost all France in paper, which I found, by some or other, "ready designed to my hand. . . Bernini's design of the Louvre I would have given my "skin for, but the old reserved Italian gave me but a few minutes view. . . I shall be able, "by discourse and a crayon, to give you a tolerable account of it." Some of his drawings are very rough and unfinished, but nevertheless they evince the hand of the master. As the father-in-law of Hogarth, and for his decoration of St. Paul's Cathedral dome more particularly, Sir James Thornhill occupies a noteworthy place in the history of English Art, and on account of his architectural decorations deservedly finds a position in our exhibition, Mr. Shoppee having lent some characteristic staircase drawings. James Stuart, who designed the first Grecian building in England, Lord Anson's house in St. James's Square, was associated with Revett in connection with their great book, *The Antiquities of Athens*, published in 1762, the first work which permanently affected English taste. I show one of the drawings which Stuart made for this folio, viz: the Temple of Rome and Augustus, at Pola—in which you will observe the fine drawing of the Corinthian capitals. Next to Stuart, in my notes, comes Sir William Chambers, and then the Brothers Adam, whose style has of late been so much affected. They were not particularly good draughtsmen themselves I think, though some of the magnificent

drawings of ceilings and other decorative subjects attributed to them, and now to be seen in the Soane Museum, are beyond all praise. I fancy these were drawn, however, by Italian artists rather than by the architects themselves, which may account for the superiority of the interiors of their buildings as compared with the external elevations. The British Coffee House, Cockspur Street, built 1770, and some mantelpieces, known to have been drawn by Adam are shown. One of the most interesting examples on the walls is a splendid watercolour by George Hadfield, Gold Medallist of the Royal Academy, 1784, and Travelling Student in 1790. He met Signor Colonna abroad and worked with him there, and in 1800 he built the north wing of the Capitol at Washington. This drawing now shown was executed ten years earlier, and represents the coffered vault of the temple at Palestrina, near Rome, for the restoration of which he and Colonna prepared designs. In the Diploma Gallery of the Royal Academy other delicately washed views in the style in fashion at this period are to be seen, chiefly drawn in elevation. For instance, there is a house designed by John Yenn, R.A., in 1791, and a watercolour of a Mausoleum, by James Wyatt, R.A., in 1785, but they are poor spiritless things quite in harmony with the buildings of the day. By far the most beautiful drawing of this date which I am able to show you is James Cave's highly-illuminated detail of the Wykeham Tomb at Winchester, dated 1797, and I would recommend a careful examination of it. From the Royal Academy of 1798 is exhibited a drawing by J. B. Papworth, representing in tinted perspective the "Interior of a Triumphal Arch," and which, according to the custom then in vogue, when glass was expensive, is varnished, so that it now has acquired a fine brown tint. Sir John Soane's design for the new House of Lords, in 1804, is represented in the Royal Academy Diploma Gallery, and need only be referred to as a heavy ponderous view, affording a curious contrast to Sir Robert Smirke's airy coloured drawing next to it of a restoration of the Acropolis at Athens, dated 1811. Sir Jeffry Wyatville, the fashionable and court architect of his time, was a much more spirited draughtsman. He was employed by George IV. to make extensive alterations to Windsor Castle, and I am able, by the courtesy of Mr. Matt. Wyatt, to show one of his drawings for this work. There is, at Burlington House, a similar perspective giving an artistic bird's-eye of a mansion for the Earl of Yarborough, dated 1826, and furnishing ample evidence of considerable skill, though, as a strictly architectural drawing, it will not compare possibly with the cold and tame view hanging hard by, the work of Wm. Wilkins, showing his gateway and cloister to King's College, Cambridge, erected in the same year. W. Porden, Atkinson and T. Cundy, are well known names of this date with the elder Nash. After Wyatville and Nash the elder, perhaps Sir Robert Smirke, the architect of Eastnor and Wilton Castles, should be mentioned, and as a prominent draughtsman his diploma drawing already alluded to bears him witness. Next we must not forget John Britton, whose simple outfit for a sketching tour, showing how he was compelled to practise economy, may serve to encourage many a poor student now. As the author of numerous important books he occupies a noteworthy place in the history of modern architecture. Charles Wild, a less known but able man, is represented here; and so is the masterly

John Carter, the early Gothic revivalist, who was also an enthusiastic worker of great skill, as you will see by the fine longitudinal section of Wells Cathedral, lent me by the Society of Antiquaries, and by his other drawing, representing Canterbury and Peterborough Cathedrals. John Coney next occurs, and he, too, was a most skilful draughtsman, his drawings being vastly superior to the "flick and dot" engravings of his, which are better known. A view of Amiens Cathedral, drawn by him, is shown. As a marine and landscape artist J. S. Cotman is mostly described, but his delineations of architectural subjects are of a high degree of merit, his published engravings and etchings being familiar to us. I am indebted to Mr. J. C. Robinson for a splendid sketch of his, showing in detail an old house at Caen. Of another type is the work of John Dobson, an architect of large practice in the north of England, who, in 1815, sent to the Royal Academy the first coloured architectural perspective exhibited there, and he is said to have been the originator of the more modern treatment of architectural drawings ; Miss Dobson has very kindly lent the picture just referred to, and also another of a very early Gothic design by the same hand. Augustus Pugin is represented by a drawing of Westminster Abbey, and I may here mention, with special thanks to Mr. J. C. Robinson and to Mr. and Mrs. J. S. Storr, the beautiful series of drawings which follow, grouped next those contributed by Mr. Ruskin, exquisitely illustrating my subject. Mr. Robinson lends a fine Prout, a typical Callcott, and a remarkably interesting study of Somerset House, by William, called familiarly "Billy," Hunt, who was chiefly known for his minute drawings of birds and still-life subjects. The view is taken from the Surrey side of the Thames, with a mason's yard in the foreground cleverly treated. From the same collection are three charming drawings, by David Cox, of quite architectural subjects, with two more lent by Mr. Storr. These show how very nearly Cox rivalled Turner, our greatest master of architectural delineation, who, as Mr. Ruskin says, "essentially leads with the utmost rightness." Next to these are hung several grand drawings executed by Mr. Ruskin himself. In these you will find ample material for study as you enjoy their exquisite beauty, and it would be simply an act of presumption on my part to refer here more at length to them. The chalk drawings from Verona, by Mr. Alfred Burgess, Mr. Frank Randal's studies from the same place, the twisted column sketch from Avallon by Mr. G. Collingwood, with regard to which note, according to the express wish of Mr. Ruskin, a comparison which is made with what he calls the "beastly "drawing in Viollet-le-Duc's Dictionary"[38] of the same pillar, and the copy of Turner's "Portico of Bernini," in the National Gallery, by Mr. W. Ward, are all works specially prepared under the direction of Mr. Ruskin, and so is Mr. G. Allen's "very exemplary" copy of a photograph of the gable over the central arch of the florid front of Abbeville Cathedral. Mr. T. M. Rooke's beautiful studies from Italy are lent by Mr. Ruskin, for whom they were made, Mr. Rooke only lately having returned from Venice, where he has been working in this way. Reverting again to our historical specimens we reach the name of Thomas Allom, who, educated as an architect, was also an artist of great ability, and Mrs. Storr contributes three fine examples of his style, as well as one from

[38] Viollet-le-Duc's *Dictionnaire raisonné de l'Architecture Française*, vol. iii. page 501.—M.B.A.

Egypt by John F. Lewis. We now come to the time of Sir Charles Barry, whose diploma drawing of The Travellers' Club is now in the Royal Academy, and I show some examples of his drawings, lent by Mr. Wolfe Barry and Mr. Vulliamy, all characteristic of their distinguished author [Illustn. xxii]. In connection with Sir Charles Barry must always be associated the great Augustus Welby Pugin, the master, if not the father of the gothic revival. As a strictly technical draughtsman he was not only by far the most able but also the most voluminous sketcher of his day, while his figure drawings, and artistic powers as a watercolour artist, are even now almost unsurpassed by architects. Mr. Pugin has lent two or three of his father's sketches [Illustn. xxiv], and to show how thoroughly the details of that great architect's designs were worked out, a folio volume of working plans for Scarisbrick Hall, Lancashire, a large mansion built by Augustus Welby Pugin in 1840, is exhibited on the table. Some years earlier he made the exquisite and miniature-like drawings, now bound in two volumes, of two original designs for "St. Marie's College," and "Le Chasteau," giving views, elevations and sections.[39] Judged by the steel engravings of Le Keux, Pugin is generally supposed to have drawn in a hard cold manner, and unsympathetic style, but a study of his autograph drawings will at once show what a false impression is given by his published works; and I may specially refer to the exquisite blue-line ink drawing exhibited, which represents an architect submitting his designs before an Episcopal Conclave. The Bishops in their mitres and robes are seated in chapter with officials of minor degree, all drawn, like the decorations and architecture, with the utmost character and finish, quite like a work by Albert Dürer in execution. It is dated 1832, the year he became acquainted with his great patron. the Earl of Shrewsbury. The original drawings for his father's books of "*Examples*," executed by himself, Joseph Nash, Benjamin Ferrey, and Mr. F. T. Dollman, are many of them as spirited as they can be, and quite unlike the cast-iron back-lined renderings seen in the books themselves, and the volume containing these originals is exhibited. To-day his memory is vividly revived to us by the exhibition of the Pugin Travelling Studentship drawings for the year, in the Institute rooms, and a more fitting memorial he would not himself, I am sure, desire. Joseph Nash, his friend, was a beautiful colourist, so simple and broad in his treatments, so free and yet so reliable; two of his telling drawings are lent by Mr. J. C. Robinson. R. W. Billings also drew well, and Edward Blore, too, was a refined and delicate draughtsman [Illustn. xxi], as well as an architect of considerable merit. His first work was Abbotsford for Sir Walter Scott, and William Burges was his most distinguished pupil. Both Billings and Blore are represented in my series, which also includes, in this connection, drawings by Talbot Bury and Benjamin Ferrey, both pupils of Augustus Pugin, and also Frederick Mackenzie, all able men, especially the latter, of whose drawings are shown some notably fine examples, and likewise Anthony Salvin, one of the most correct of gothic architects and an admirable artist, as may be seen by his sketches of Carew Castle. Of another school was the

[39] *St. Marie's College, designed and drawn by A. W. N. Pugin, anno Christi* 1834; and *Le Chasteau, inventé et dessiné par Auguste Welby Pugin, l'an de grace* 1833: the former consisting of 64 pages of illustrations and the latter of 41 pages, all by his hand.

learned Professor Cockerell [Illustn. xx], whose beautifully finished academical studies are worthy of his distinguished name; Mrs. F. P. Cockerell has generously placed some exquisite examples at our disposal for exhibition with others by her husband, our late and truly lamented Hon. Secretary, who, like his father, was also a graphic artist and an excellent painter in watercolour. Sydney Smirke, too, was a most industrious sketcher, and some examples of his skill are shown, with others by George Aitchison, who was considered one of the finest line draughtsmen of his day. The drawings are lent by his son, Mr. George Aitchison, A.R.A. John Shaw, J. J. Scoles and J. C. Buckler, may here be mentioned, leading on to Mr. P. C. Hardwick and S. W. Dawkes, who built St. Andrew's Church, Wells Street. Thus we reach Sir Gilbert Scott, the great popular architect of the nineteenth century, the restorer of many of our cathedrals, and the author of the most able Royal Academy lectures yet delivered. As a delineator of architecture he was not so accomplished as some of his pupils, and his own drawings are not numerous, but those early specimens, which I am now able to show, sufficiently illustrate his power with the pencil. Sir M. Digby Wyatt, both with the pen and the brush, was equally a rapid and artistic worker; his care is evident in most of his drawings, as was seen by the large views shown at the Burlington Fine Arts Club last summer, and in the watercolour pictures from his hand exhibited here to-day. Of George Edmund Street, R.A., as an architect and as a draughtsman, few can speak surely without feeling their own remote distance from him. His drawings show with what a splendid and unsurpassed power he mastered either the use of the pen [Illustn. xxvi.], the brush or the pencil, and his churches at Clifton, Kennington and Paddington, to say nothing of the grand pile in the Strand, are enough, without any other of his many buildings, to perpetuate his memory as, in my opinion, the most robust and pre-eminently English architect of the nineteenth century.

Few persons had any idea how well Street could draw the figure, but the sketches of men in armour from Innsbrück, shown in the present series [Illustn. xxvii], are equal to anything drawn by Viollet-le-Duc. Of this great man I need say but little, as you know his wonderful drawings so well, and my references have purposely been restricted chiefly to English examples of drawing. No list of modern specimens would, however, be complete without an illustration of Viollet-le-Duc's great powers of draughtsmanship, and so I have borrowed from Mr. Wethered an original pencil drawing showing the Romanesque church at Saintes [Illustn. xxv], while Viollet-le-Duc's memorial book of autograph facsimiles is in the Library. Our own great mediævalist, William Burges, as you are well aware, was every inch of him an artist, peculiar perhaps in his special manner, but as powerful in his strength of drawing as he was exquisite in the subtle refinement of his good taste. To know him was to love him; and whenever he taught us anything it was always worth remembering. On the subject of drawing there could be no better authority, and the chief lesson which he gave us in this respect was the prime importance of learning to draw the figure. Some specimens from his hand are shown, and others belong to our Library [Illustns. xxviii, xxix]. Mr. Spiers has kindly lent a very fine coloured drawing by Professor E. Brune, giving a "Study of Superimposed

"Orders" [Illustn. xxxviii], which, with his own "Study of Design," executed in Paris, and his beautiful drawing of a Corinthian capital [Illustn. xxxix], most ably represent the typical French style of architectural drawing. Bruce Talbert was a draughtsman of high merit, and so was my friend, the late Fred. C. Deshon, one of Street's most gifted pupils. I show examples of their powers, and with these my remarks must conclude; for, having arrived at the group of drawings lent me by architects and artists still living, it would be invidious and unwise to particularize instances, especially as my own work is represented. There are two names, however—nay, four, which I may perhaps be pardoned for mentioning. Foremost Mr. Norman Shaw, R.A. [Illustn. xxxiv], who alone, and in company with Mr. Eden Nesfield, has done so much, by brilliant example, for draughtsmanship, and for homely domestic architecture. Then the gifted and original architect, Mr. E. W. Godwin, F.S.A., from whom we expected even more than he has given us; and my other two names are those of Mr. Ernest George [Illustn. xxxiii], and Mr. A. H. Haig, whose etchings of architecture, though so different in style, are certainly among the few really delightful things of the day. I cannot tell you how I admire them. Only one reference more, and this is to the importance and increased usefulness of photography for architectural studies, which, owing to the convenient and easy application of the dry plate process, is placed within the reach of all. Mr. J. L. Robinson, of Dublin, who has for some years taken photographs of the places visited during the Architectural Association's Excursions, has lent some admirable specimens for exhibition here to-day, as the work of an amateur photographer who is also an architect.

MAURICE B. ADAMS.

[Remarks on the Foreign System of shading and tinting drawings, by R. Phené Spiers, F.S.A., *Fellow;* Master of the Architectural School at the Royal Academy of Arts.]

The object of tinting a geometrical elevation, and blacking the windows, is to bring out its mass and minimize the effect of its lines, which do not exist in an actual building, and are only drawn to indicate the general design and construction. A further object, and one which is of great importance, is to indicate the colour of the materials employed. A pen and ink drawing fails entirely to convey the effect of a building, in which red brick and stone are used in conjunction. Of course if the drawing be tinted in monochrome, the tints indicate the relative values of the colours only. To these two processes it is the custom in France and elsewhere to add a third—that of the projection and tinting of shadows. Now it is obvious that, with some slight knowledge of geometry, it would be possible to project shadows at any angle one pleased, at 60° to 70° vertically on a south front, or at 20° to 40° on an east or west front, and under these circumstances, possibly, the actual effect of the building as a mass and in detail might be better obtained. The object, however, of projecting shadows at 45° has nothing to do with the future lighting by the sun; it is simply a conventional way of representing, on one drawing, that which it would otherwise take three at least to explain. The shadow is supposed, of course, to be thrown by the sun (for convenience sake on account of the parallelisms of its rays).

The sun is assumed to be behind the spectator in a plane which is situated, both horizontally and vertically, at an angle of 45° to the front of the building. The depth of any shadow, therefore, either vertically or horizontally, *represents the distance of the line or point throwing the shadow from the plane on which the shadow is thrown.* The vertical shadow, therefore, would indicate the projection of a cornice which otherwise could not have been understood without a section; the horizontal shadow shows the projection of a column, a pilaster, or of a block of the building, which otherwise would have required a plan to indicate it. How many plans might be required at every level, or how many sections through varying portions of the design, would depend on the importance and intricacy of the design ; it is sufficient here to dwell on the fact that, by a purely conventional process, it is possible in a single drawing to concentrate the results of many. Now, the advantage of this is very great. It is very difficult, in turning from one drawing to another, to realize their effect when taken together, and this is specially felt in small returns, or in the projections of cornices and columns. In the shaded elevational drawings these are seen in juxtaposition, and their relative effect to the whole mass can be judged of with an exactness which no perspective would give. At the same time, I am bound to point out that a properly tinted and shaded drawing is, like a language, unintelligible to those who are not acquainted with its technicalities, though easily read and understood by those who have used and studied it during their professional education. It conveys more than fifty perspective drawings could do, and it takes but a tithe of the time to execute. As a means of studying a design, it is invaluable ; in fact, I doubt very much whether it is possible to do without it, except in the case of a man of very distinct views, who is able to conceive in his brain a clear conception of what he requires, and even to him it would serve as a record.

I have hitherto only alluded broadly to the delineation of shadows projected at 45°, to tinting in flat tones to represent masses, and to the distinguishing of the various materials used. There are, however, three more processes to be noted. The first is the graduation of tints, which, in the French school, is from the top to the bottom of the drawing, probably suggested by the supposed brilliant reflection from the ground. This leads to the second, which is the counter reflection, giving transparence to the shadows, and indicating the detail in the parts in shade. In Germany, the light is invariably assumed to be greater nearer to the sun, and therefore the drawings are graduated from bottom to top. The third process is the setting back, in their relative planes, the retiring portions of the building. When colour is used, this is comparatively easy to understand, the warmer tones coming in front, the retiring portions being colder, and sometimes blue in tone. In monochrome drawings, in Indian ink, for instance, this becomes more difficult, and is generally effected by the more intense shadows of the projecting portions, those in the back being easily distinguishable from the flat wash laid over them.

To arrive at all these results, the student commences by copying a large detail in Indian ink, in which he acquires the power of washing in that most difficult of all colours to lay, in flat and in graduated tones. After one or two of these studies, he proceeds to copy a study of Corinthian columns, fluted, and then to an advanced

study of a Corinthian capital [Illustn. xxxix], or to some simple monument in colours. As soon, however, as he enters the School and commences to prepare designs, his attention is more or less confined to the tinting of the successive studies of his design, sometimes in an original drawing on paper, and sometimes on the series of tracing-paper studies. This system of using tracing paper is but rarely employed in England. It is, however, of the greatest service. It economizes time, as a study on tracing paper, when the axial lines are set out, can be made quicker than a fresh drawing. It allows, also, of various subtle modifications in the design, and of subsequent comparison. When the general massing on a small-scale drawing is approved of, the design is set out to a larger scale, with shadows projected, tinted, and subsequent studies of detail on tracing paper. The necessity of correctly representing the main shadows on the elevational drawing has made the student conversant with the nature of the returns and the side elevations. His drawing has long been converted from a plane surface to a series of solids advancing or retiring one from the other. I note the importance of this, because I too frequently find students working out a design in line only as if it were a decoration on one plane, and never thinking for a moment of what the returns of the advancing blocks or columns or pilasters may be. When preparing drawings for the school competitions, the studies are continued until time presses, and it becomes necessary to commence the "*rendu*," or finished drawing. The finished drawing, if the previous studies have been considerable, will sometimes be left in pencil and tinted. If it be put in ink, the lines are necessarily drawn as fine as possible, so as not to interfere with the effect of the shading, which deals with masses and not with lines. The system of projecting shadows is carried into the plan and sections, with certain modifications in the former; in plans, the covered portions of the buildings are left white, and the courts and surrounding ground tinted pale grey; on to these grey grounds a shadow, as it were, of a plinth, 2 ft. in height, is projected. The walls are always tinted jet black; statues or lamps are placed in a pale tinted vermilion to distinguish them from columns. In gardens isolated trees are indicated by small circles, as if they had been cut through the trunk, and small shadows are projected. Masses of foliage are, indicated by washes of green, made with Indian yellow and the French "ultramarine," which deposits freely and suggests foliage; the garden paths are tinted light burnt sienna, and grass is shown by flat washes of green. The covered portions of the building are left white, but an indication is made of what might either be a *parquet,* or the design for the ceiling, if it be a large room, suggesting the construction with beams and coffers; the design of this parquet suggests the importance of the room. The section is invariably supposed to be taken through the centre of the chief rooms: by custom, therefore, a room which has a vertical shadow projected of 12 ft. deep is recognized as being 24 ft. long. It is usual to indicate the coloured decorations, however simple they may be, in every room, and in order not to interfere with this all sectional parts are tinted a pale pink.

I ought perhaps to state that these highly finished drawings are made for two purposes, first, to enable the architect to study and judge of the ultimate effect of his design, and secondly, for exhibition in the "Salon" or in the office. The drawings sent to the work-

men are traced from them without shading; for the sculpture-decoration, whether ornament or figures, the shadows are projected on the tracing; and the French sculptor is trained to understand the intended projections of the various parts. My advocacy in favour of the principle of this system of drawing would be incomplete were I not to add that, in those cases in which I have seen both drawing and building, the actual effect of the latter has corresponded perfectly with the representation in the former. I have already referred to an illustration, the Corinthian capital [xxxix.], as being from one of the advanced studies made to acquire the power of shading in Indian ink. In this case the original drawing was made from an ancient example. Another illustration [xxxviii.], taken from an original design by M. Emmanuel Brune (Grand Prix de Rome, 1863, and now Professor of Construction at the École des Beaux-Arts), affords a perfect explanation of my meaning; reference to the paper[40] which I read in 1884 on the French Diplôme d'Architecte will show that it was one of those studies set once in each year to train the students of the École des Beaux-Arts in the classic Orders of architecture.

R. PHENÉ SPIERS.

LIST OF DRAWINGS EXHIBITED.

ARTIST.	SUBJECT OF DRAWING.	CONTRIBUTOR.
ADAM: THE BROTHERS.	British Coffee House, Cockspur Street, 1770.	Wyatt Papworth, *Fellow.*
"	Two designs for fire-places.	C. J. Shoppee, *Fellow.*
Adams: Maurice B., *Associate.*	Pen and Ink drawing of Blickling Hall, Norfolk, now being restored under Mr. Adams's supervision [Illustn. xxxvii.]	The Artist.
"	Proofs (bound in five volumes) of photolithographs of drawings and designs published in "*The Building News*," from 1872 to 1883.	"
AITCHISON: GEORGE.	Design for a Gothic Palace and Bridge, about 1826.	Geo. Aitchison, A.R.A., *Member of Council.*
"	St John's Westminster (plans and elevations.)	
"	Competition design for new London Bridge.	"
Aitchison: Geo., A.R.A., *Member of Council.*	Watercolour interior of S. Lorenzo, Rome (outside the walls).	The Artist.
"	Watercolour interior of St. Mark's, Venice.	
Allen: W. G.	Gable over central arch of the front of Abbeville Cathedral, modified and enlarged from a photograph.	John Ruskin, M.A., *Hon. Fellow.*
ALLOM: THOMAS.	Competition design for an interior of the Assize Courts, Manchester [Illustn. xxiii.]	Mrs. J. S. Storr.
"	The Great Gate of the Seraglio, Constantinople.	
BARRY: SIR CHAS., R.A., VICE-PRES., R.I.B.A., (*Royal Gold Medallist.*)	Design in pencil for Dunrobin Castle [Illustn. xxii.]	George Vulliamy, *Past Vice-President.*
	Pencil drawing of the Temple of Rameses II., at Luxor, Egypt.	J. Wolfe Barry, *Hon. Associate.*
BILLINGS: R. W.	Courtyard, Newark Castle.	John Hebb, *Fellow.*
"	Pencil sketch of the decoration of the dome of St. Paul's Cathedral as painted by Sir James Thornhill [Illustn. vi. *ante.*]	Mr. J. Drayton Wyatt.
"	Pencil sketch of the coffers, painted by Sir James Thornhill, around the eye of the dome of St. Paul's Cathedral [Illustn. vii. *ante.*]	"
BLORE: EDWARD.	Interior of Rosslyn Chapel.	Rev. E. W. Blore, M.A.
"	The Babington Family Tomb, Kingston, Somersetshire [Illustn. xxi.]	"
Brewer: H. W.	Sketch of the Great Organ, Bois-le-Duc, Holland.	The Artist.
Brune: Professor.	Study [Illustn. xxxviii.] in Indian ink of superimposed Orders (drawn in 1860 at the École des Beaux-arts, Paris.)	R. Phené Spiers, F.S.A., *Fellow.*

[40] See the TRANSACTIONS, 1883-84, page 127.

ARTIST.	SUBJECT OF DRAWING.	CONTRIBUTOR.
BURGES: WM., A.R.A.	"Pattern for Fountain with the Story of Sabrina."	R. P. Pullan, *Fellow.*
"	Sheet from "The Vellum Sketch Book," the property of William Emerson, *Fellow* [Illustn. xxviii.]	Maurice B. Adams, *Associate.*
"	Details of designs, domestic and ecclesiastic; Mr. Burges's Elephant Inkstand [Illustn. xxix.]	The R.I.B.A.
Burgess: Alfred.	Capital from Scala tombs; Rose on span of a boss, Sta. Anastasia, Verona.	John Ruskin, M.A., *Hon. Fellow.*
BURY: TALBOT, VICE-PRESIDENT, R.I.B.A.	View of the pulpit, Strassburg Cathedral.	Matt. Wyatt, *Fellow.*
BYFIELD: —	Coloured drawing of a Casino, 1782.	George Aitchison, A.R.A., *Member of Council.*
CALLCOTT: SIR A. W.	Verona, on the River, 1835.	Mr. J. C. Robinson.
CARTER: JOHN.	Wells Cathedral (longitudinal section.)	The Society of Antiquaries.
"	Canterbury and Peterborough Cathedrals (general views.)	Rev. J. C. Jackson, M.A.
CAVE: JAMES.	The Wykeham Tomb, Winchester Cathedral.	"
CHAMBERS: SIR W., R.A.	Designs and drawings made in his office.	The R.I.B.A.
Clarke: E. F. C.	Pen and ink drawing of a house at Rotherham.	The Artist.
COCKERELL: CHARLES ROBERT, R.A., PRESIDENT, R.I.B.A. (*Royal Gold Medallist.*)	Interior of a Basilican Church [Illustn. xx.]	Mrs. F. Pepys Cockerell.
	The remains of the Temple of Jupiter Olympius, with a view of the Acropolis, &c.	"
COCKERELL: FRED. P. HON. SEC., R.I.B.A.	Study of Mausoleum at Halicarnassus.	"
Collingwood: G.	Twisted column, Avallon.	John Ruskin, M.A., *Hon. Fellow.*
CONEY: JOHN.	Amiens Cathedral (pencil drawing.)	W. J. N. Millard, *Associate.*
COTMAN: J. S.	Old House, Rue St. Jean, Caen, 1817.	Mr. J. C. Robinson.
COX: DAVID.	Leominster Church.	Mr. J. S. Storr.
"	St. Paul's Cathedral from the Thames.	"
"	Greenwich Hospital.	Mr. J. C. Robinson.
"	St. Eustache, Paris.	"
DESHON: F. C.	Pen and ink sketch of the tower and transept of the Church of Senlis, France.	Maurice B. Adams, *Associate.*
DOBSON: JOHN.	Seaton Delaval.	Miss Dobson.
	*** First coloured drawing of a strictly architectural subject, shown at the Exhibition of the R.A., 1815.	
"	St. Thomas's Church, Newcastle-on-Tyne, 1824.	"
FERREY: B., VICE-PRESIDENT, R.I.B.A. (*Royal Gold Medallist.*)	Pencil sketches of continental subjects.	B. Edmund Ferrey, F.S.A., *Fellow.*
FLITCROFT: H.	Whitehall Palace (original drawings for Kent's *Works of Inigo Jones.*)	The R.I.B.A.
Garratt: T., *Associate.*	View of Old Chiswick Church, 1881.	The Artist.
George: Ernest, *Fellow.*	Chimneys at the Château de Chambord.	The Artist.
"	Staircase at Barcelona.	"
"	Etching of a Tower at Amsterdam [Illustn. xxxiii.]	"
	*** Presented by Mr. Ernest George to the R.I.B.A.	
Godwin: E. W., F.S.A.	Pen and ink sketches in Normandy.	Maurice B. Adams, *Associate.*
"	North-West view of a town Church.	The Artist.
HADFIELD: GEORGE.	Ancient remains, Præneste.	The R.I.B.A.
Haig: A. H.	Seville Cathedral.	The Artist.
"	A study in the Alhambra.	"
"	A corner in Seville Cathedral (etching.)	"
HARDWICK: THOMAS.	Numerous sketches and measured drawings made in France and Italy.	The R.I.B.A.
"	Drawings made when a pupil in the office of Sir William Chambers, R.A.	"
Hilliard: Laurence.	Three wooden brackets in The Fish Market, Chartres [Illustn. xxxii.]	John Ruskin, M.A., *Hon. Fellow.*
HUNT: W.	Somerset House, from a mason's yard on Surrey side of the Thames	Mr. J. C. Robinson.
Jackson: T. G., M.A., F.S.A.	Watercolour drawing of the Market tower, Bruges.	The Artist.
"	Watercolour drawing of the Apse, Duomo, Parenzo.	"
Johnson: R. J., *Fellow.*	Pen and ink view of the Choir of Westminster Abbey, from the Chapel of St. John.	The Artist.

ARTIST.	SUBJECT OF DRAWING.	CONTRIBUTOR.
JONES: INIGO.	Whitehall Palace, (1) "The Water side;" (2) "The West Münster side."	H.M. The Queen, *Patron of the R.I.B.A.*
	*** The original perspectives submitted to King James the I.	
,,	Portico to Old St. Paul's.	The Duke of Devonshire K.G., *Hon. Associate.*
,,	Sheet of capitals, panels, &c.	
,,	Designs for fireplaces, 1636 (2 sheets).	,,
,,	Scene for Court Revels, &c.	,,
,,	Sheet of Arabesque carvings and Pilasters.	,,
Knight: F. G., *Associate.*	View of Mont St. Michel, France.	The Artist.
Langham: J.	Pen and ink view of an old Manor House [Illustn. xxxv.]	The Artist.
Leeming and Leeming: Messrs.	Pen and ink drawing of accepted design for the new Admiralty and the War Office, Whitehall, S.W.	The Artists.
Lethaby: W. R. (*Soane Medallist and Pugin Student.*)	View of Langeais Towers on the Loire.	The Artist.
LEWIS: J. F.	Ruins of Thebes, Upper Egypt.	Mrs. J. S. Storr.
MALTON: THOMAS.	Old Palace Yard, Westminster.	E. H. Martineau, *Fellow.*
MACKENZIE: FREDK.	Beverley Minster, York.	R. Phené Spiers, F.S.A. *Fellow.*
	Radcliffe Library, Oxford.	
	Trinity College, Cambridge—Entrance Gateway.	Mr. Sydney Smirke.
	King's College, Cambridge—the Hall.	,,
Millard: Walter J. N. *Associate* (*Pugin Student.*)	View of the North-west Tower of Rouen Cathedral.	The Artist.
NASH: JOSEPH.	Interior of Hall, Wollaton.	Mr. J. C. Robinson.
,,	Interior of Hall, Hampton Court Palace.	,,
Nesfield: W. E.	Pen and ink views of Gregynog Hall, Montgomeryshire, and of Cloverley Hall, Shropshire.	Maurice B. Adams, *Associate.*
PAPWORTH: J. B., VICE-PRESIDENT, R.I.B.A.	Interior of a Triumphal Arch, Rome, 1798.	Wyatt Papworth, *Fellow.*
Pite: W. A., *Pugin Student.*	The Tower and Spire of St. Mary, Bloxham.	The Artist.
PROUT: SAMUEL.	Trèves, 1851, and Amiens.	Mr. J. C. Robinson.
PUGIN: AUGUSTUS.	Westminster Abbey.	Mr. P. P. Pugin.
PUGIN: A. W. N.	Design with figures for the title-page of a Book, in blue ink, 1832.	Messrs. Pugin and Pugin.
,,	The Bishop's Palace, Beauvais.	,,
,,	Sketch in Munich, 1838 [Illustn. xxiv.]	,,
,,	Working drawings of Scarisbrick Hall, Lancashire.	,,
,,	Volume of original drawings by the late B. Ferrey, the late Joseph Nash, the late Talbot Bury, the late A. W. N. Pugin, and F. T. Dollman, *Associate,* for the published works of Augustus Pugin.	,,
Randal: Frank.	South Porch, Duomo, Verona.	John Ruskin, M.A., *Hon. Fellow.*
,,	West end of Ponte della Pietra, Verona.	
Rooke: T. M.	Study of Colour, Ducal Palace, Venice.	,,
,,	Church front at Brieg.	,,
RAPHAEL.	Design for the Church of S. Lorenzo, Florence, (photograph from the original).	Maurice B. Adams, *Associate.*
Robinson: J. L.	Series of 16 photographs of architecture, taken during the annual excursions of the Architectural Association, 1878-85.	The Artist.
Ruskin, John, M.A., *Hon. Fellow.*	Main pier of Duomo, Lucca.	The Artist.
	Details of angle shaft, Duomo, Lucca [Illustn. xxx.]	,,
,,	Notes of archivolts, Lucca.	,,
,,	Dragon of porch, Duomo, Assisi.	,,
,,	Archivolt at Fuligno.	,,
,,	Notes of masonry, La Spina, Pisa.	,,
,,	Leaf ornament, Baptistery, Pisa.	,,
,,	Bracket Sculpture at Verona [Illustn. xxxi.]	,,
,,	Outline at Lauffenburg.	,,
,,	Side of Grande Place, Abbeville.	,,
,,	St. Wulfran, Abbeville.	,,
,,	Crocket, Abbeville.	,,
,,	River suburb of Fribourg.	,,
SALVIN: A., VICE-PRESIDENT R.I.B.A. (*Royal Gold Medallist.*)	Two sketches of Carew Castle, 1845.	Mr. Salvin.

ARTIST.	SUBJECT OF DRAWING.	CONTRIBUTOR.
SAYER: E. C.	Watercolour drawing of the interior of St. Paul's Cathedral, as proposed, from Sir Christopher Wren's model [Illustn. viii. *ante*].	Arthur Cates, *Member of Council.*
"	Elevations and sections of the same.	The R.I.B.A.
SCOLES: J. J.	Sketches at Athens, 1824.	S. J. Nicholl, *Associate.*
SCOTT: SIR GILBERT, R.A., PRESIDENT R.I.B.A. (*Royal Gold Medallist.*)	Pencil sketches of the interior of Lincoln Cathedral and of Tattershall Castle, 1840.	J. O. Scott, *Fellow.*
	Sheet of various sketches of Capitals, &c.	"
Shaw: R. Norman, R.A.	Pen and Ink View of the Wispers, Sussex [Illustn. xxxiv.]	The Artist.
SMIRKE: SYDNEY, R.A., VICE-PRESIDENT R.I.B.A. (*Royal Gold Medallist.*)	Pencil sketches of Sta. Maria dei Miracoli, Venice, and of the Ducal Palace, Ferrara.	Mr. Sydney Smirke.
Spiers: R. Phené, F.S.A., *Fellow.* (*Soane Medallist*).	Study of design made at the École des Beaux-Arts, Paris, 1860.	The Artist.
"	Watercolour drawing of the Parthenon, Athens.	"
"	A Capital of the Corinthian Order, drawn in 1870. [Illustn. xxxix.]	"
STREET: G. E., R.A., PRESIDENT, R.I.B.A. (*Royal Gold Medallist.*)	Watercolour sketch of the Hall, Penshurst Castle.	Arthur E. Street, M.A., *Associate.*
	Watercolour sketch of the Baptistery, Pisa.	
	Pencil sketches:—Transept of Coutances Cathedral, looking north, 1855.	"
"	Nave of same.	"
"	Central tower of same.	"
"	Spires of same.	"
"	West front of Bourges Cathedral.	"
"	Nave of same, looking north, 1856.	"
"	Interior of Notre Dame, Chalons-sur-Marne, 1858.	"
"	Porch of the Cathedral, Genoa.	"
"	Pen and Ink drawing of Porch, Bristol Cathedral, 1867. [Illustn. xxvi.]	"
"	Pen and Ink drawing of a portion of the Royal Courts of Justice.	"
"	Sketch of Figures in armour at Innsbrück, 1880. [Illustn. xxvii.]	"
STUART: JAMES,	Temple of Rome and Augustus, Pola.	The R.I.B.A.
TALBERT: BRUCE,	View of Coventry Spires.	J. M. Brydon, *Fellow.*
THORNHILL: SIR JAMES.	Staircase Decorations (two sheets).	C. J. Shoppee, *Fellow.*
UNKNOWN.	Whitehall Palace, by Inigo Jones (an elevation).	Mr. Chas. H. Halstead
VIOLLET-LE-DUC: E. E., HON. CORR. MEM., R.I.B.A. (*Royal Gold Medallist.*)	A ruined Romanesque church, Saintes, 1835 [Illustn. xxv.]	Mr. Charles Wethered.
Ward: W.	The Colonnade of St. Peter's, Rome (a copy of Turner in the National Gallery.)	John Ruskin, M.A., *Hon. Fellow.*
Waterhouse: Alfred, A.R.A., *Vice-President.* (*Royal Gold Medallist.*)	Porch, North transept of Chartres Cathedral.	The Artist.
	Temple of Juno, Girgenti.	"
	Sketches at Angoulême, Arezzo, and Poitiers.	"
Weatherley: W. Sam., *Associate.*	Pen and ink interiors of the Cathedrals of Sens and Canterbury, showing the work of William of Sens in juxtaposition [Illustn. xxxvi.] **** Made for the late Sir Gilbert Scott's Lectures on Architecture at the Royal Academy of Arts.	The Artist.
WILD: CHARLES.	Town Hall, Cologne.	Mr. J. W. Wild.
WREN: SIR CHRISTOPHER.	Steeple of Bow Church (plan and sections.)	All Souls College, Oxford.
	Ingestrie Hall (plan and view.) **** Called Walter Chetwynd's House.	"
"	Mausoleum proposed to have been erected at Windsor to the memory of Charles I.	"
"	Baluster and festoon (possibly for St. Paul's.)	"
WYATT: SIR M. D., VICE-PRESIDENT R.I.B.A. (*Royal Gold Medallist.*)	Watercolour drawing of S. Bernardo, Perugia.	Matt. Wyatt, *Fellow.*
	Watercolour drawing of Pulpit.	"
WYATVILLE: SIR JEFFRY, R.A.	Sketch view of alterations at Windsor Castle.	Matt. Wyatt, *Fellow.*

*** The names printed in full capitals indicate artists who are deceased.

VI. ARCHITECTURAL DRAWING (xx)

89. CHARLES ROBERT COCKERELL, A.D. 1788 - 1863.

90, EDWARD BLO

RITISH ARCHITECTS, VOL. I_NEW SERIES.

DRAWING. (XXI).

, A.D. 1789-1879.

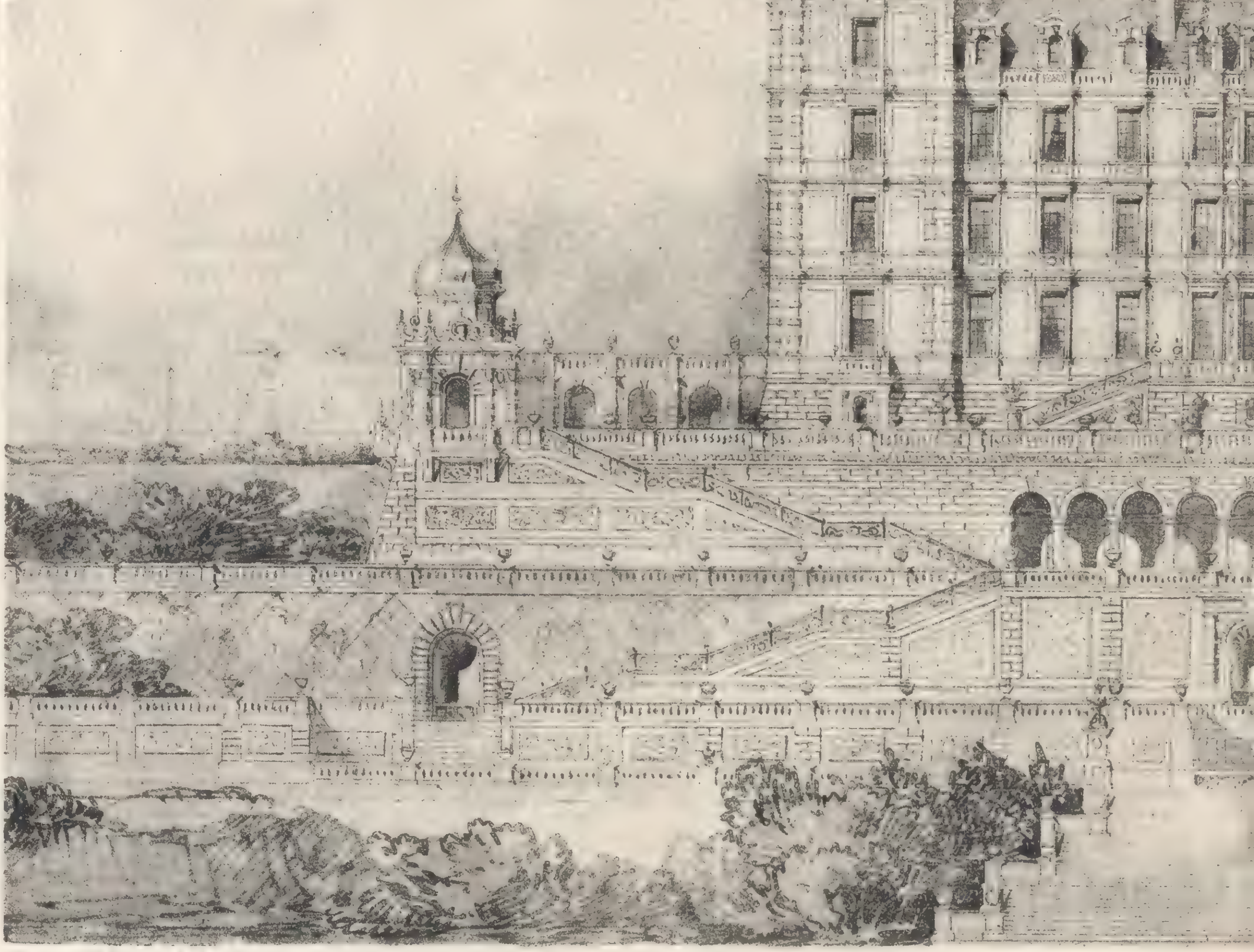


PHOTO. SPRAGUE & C. LONDON.

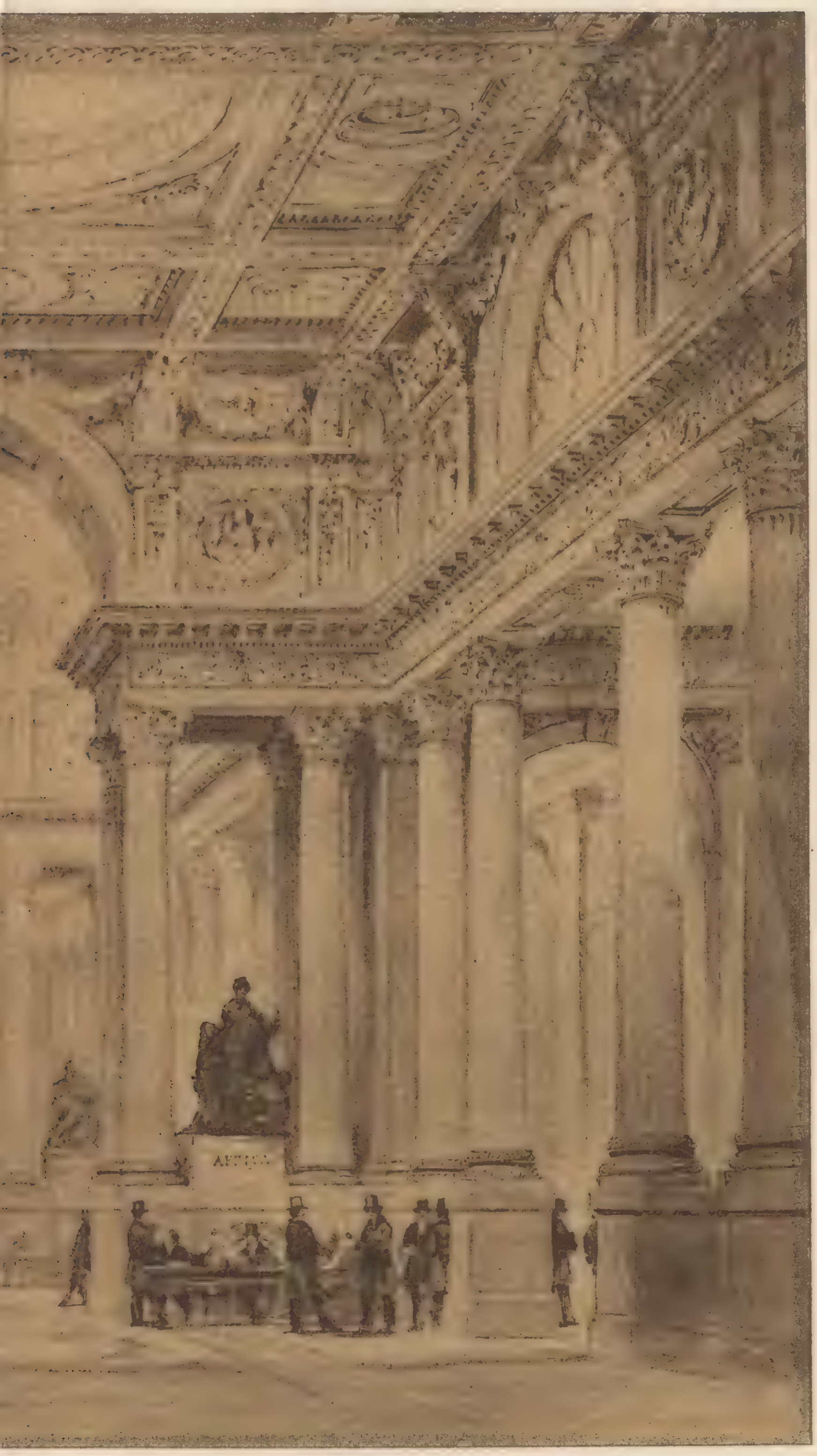
91, SIR CHARLES

L DRAWING. (XXII).

BARRY, A.D. 1795-1860.

INK PHOTO. SPRAGUE & C°. LONDON

92, THOMAS ALL



M, A.D. 1804-1872.

INK-PHOTO, SPRAGUE & Co LONDON.

93, AUGUSTUS WELBY NORTHMORE PUGIN, A.D. 1812-1852.

VI. ARCHITECTURAL DRAWING. (XXV).

94, EUGÈNE EMMANUEL VIOLLET-LE-DUC, 1814-1879.

VI ARCHITECTURAL DRAWING (XXVI.)

C F Kell Photo-lith & Printer 8 Castle St Holborn, London E C

95. GEORGE EDMUND STREET, A.D. 1824 - 1881.

C F Kell Fac-sim et Lith Castle St. Holborn W.C.

96. GEORGE EDMUND

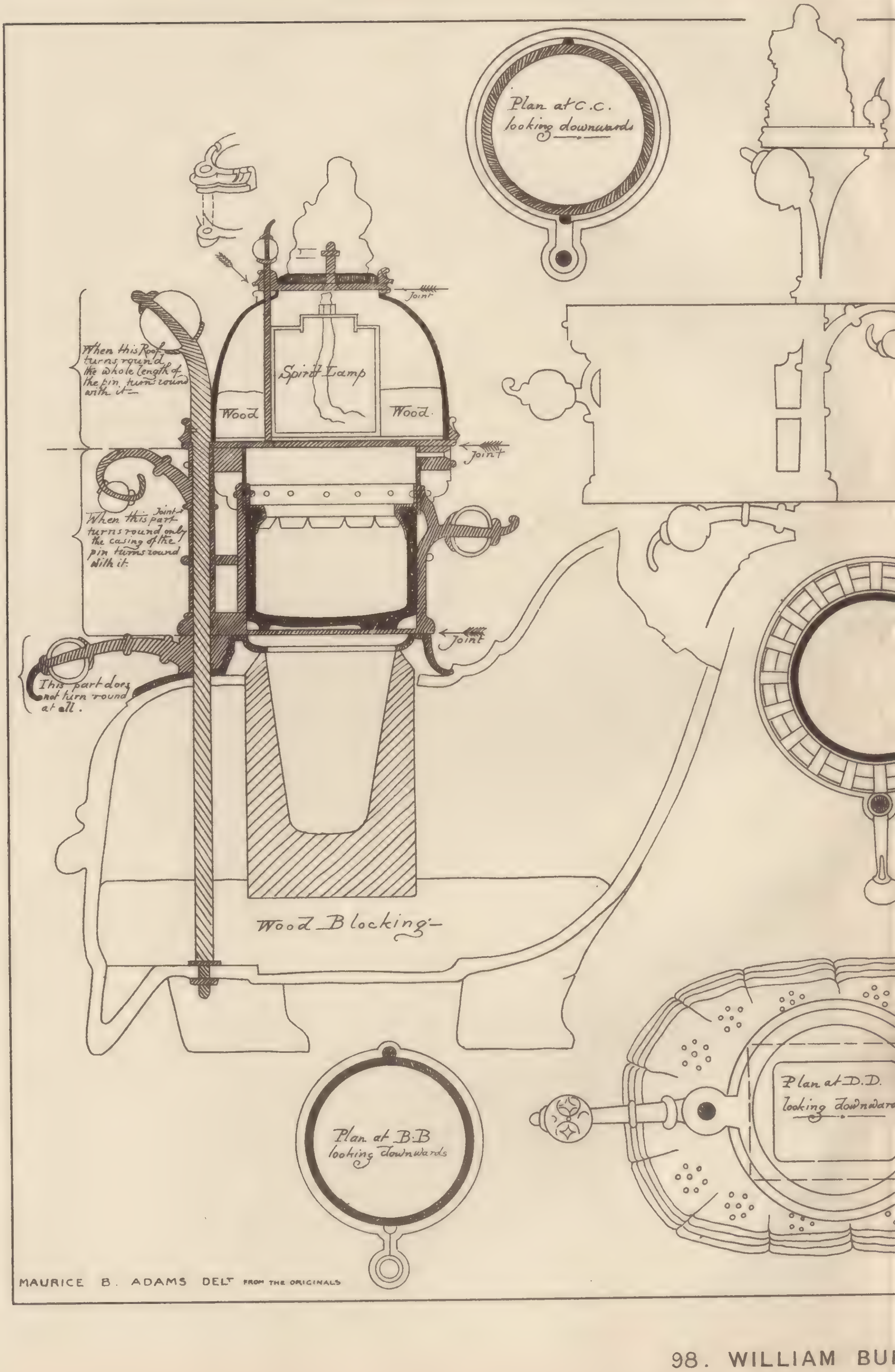
TREET, A.D. 1824 - 1881.

VI. ARCHITECTURAL DRAWING (XXVIII)

MAURICE B. ADAMS DELT FROM "THE VELLUM SKETCH BOOK"

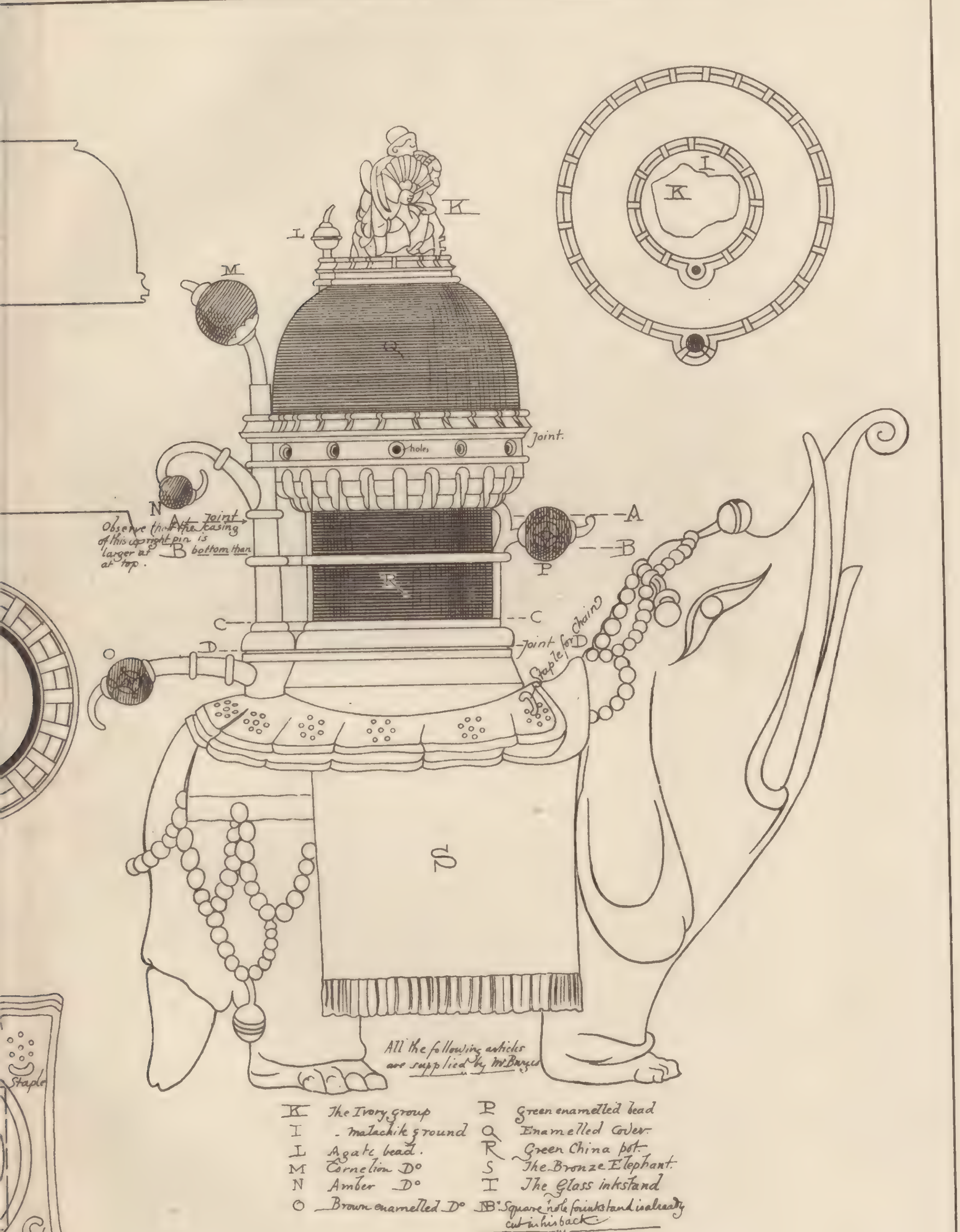
Photo-Lithographed & Printed by James Akerman, 6, Queen Square, W.C.

97. WILLIAM BURGES. A.D. 1827-1881.



MAURICE B. ADAMS DEL^T FROM THE ORIGINALS

98. WILLIAM BU



Inkstand designed by Mr. Burges
and used by him

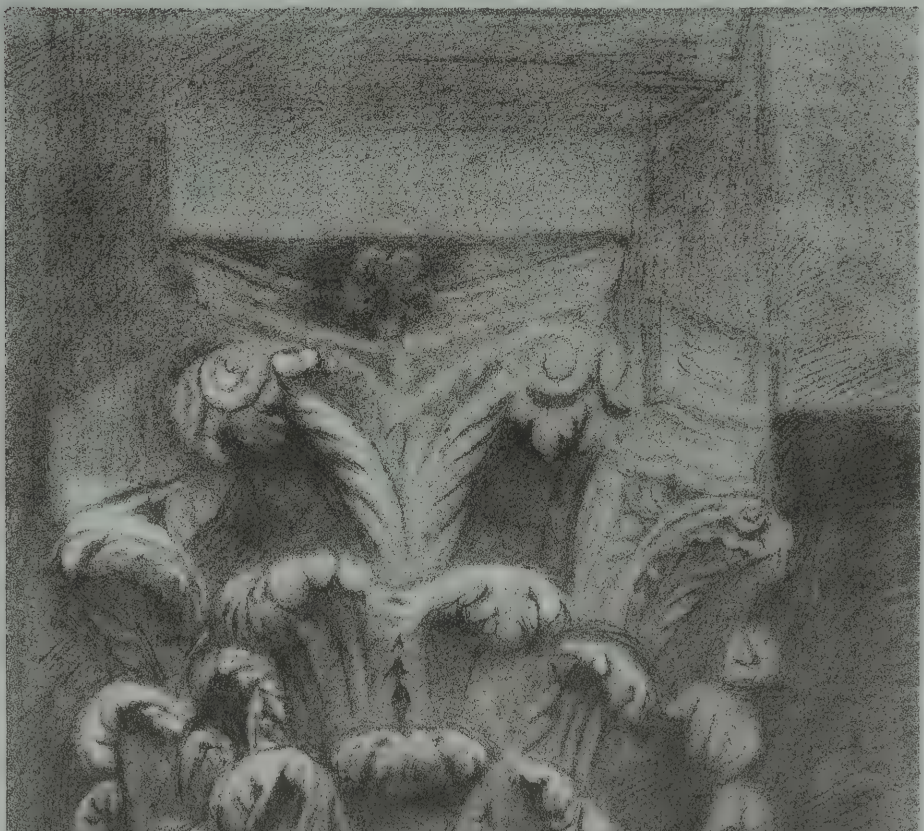
C. F. Kell Photo-Lith & Printer. 8. Castle St. Holborn. London E.C.

VI. ARCHITECTURAL DRAWING. (xxx).

"INK-PHOTO" SPRAGUE & CO LONDON

99, JOHN RUSKIN, M.A., *Hon. Fellow.*

VI. ARCHITECTURAL DRAWING. (XXXI).



"INK-PHOTO" SPRAGUE & CO LONDON

100, JOHN RUSKIN, M.A., *HON. FELLOW.*

"INK PHOTO" SPRAGUE & CO LONDON

101, THREE OLD BRACKETS FROM THE FISH M

[ORIGINAL SKETCHES IN T

DRAWING. (xxxii)

KET, CHARTRES, BY M^{R} LAURENCE HILLIARD.

POSSESSION OF M^{R} RUSKIN.]

VI. ARCHITECTURAL DRAWING (XXXiii).

AMSTERDAM. ERNEST GEORGE.

VI ARCHITECTURAL DRAWING (XXXIV)

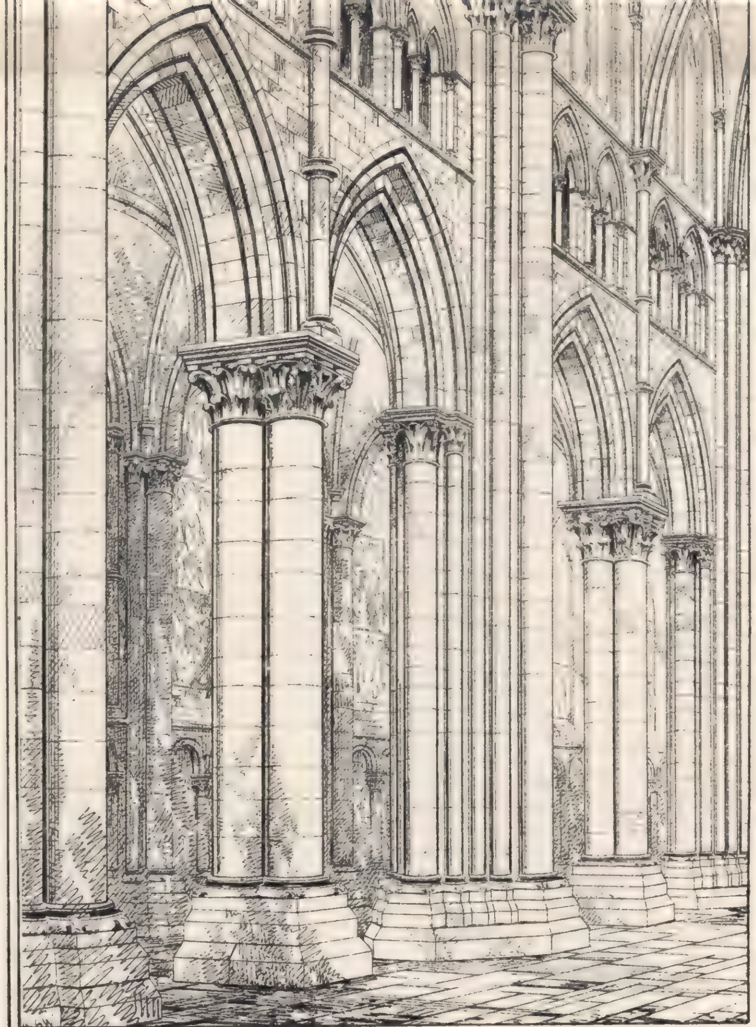
R. Norman Shaw, R.A Archt.

103. THE WISPERS, SUSSEX. REDUCED FROM A DRAWING BY R. NORMAN SHAW, R.A.

VI ARCHITECTURAL DRAWING (XXXV)

104. AN OLD MANOR HOUSE, REDUCED FROM A DRAWING BY Mr. J. LANGHAM.

VI ARCHITECTURAL DRAWING (XXXVI)



C. F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

SENS CATHEDRAL.

CANTERBURY CATHEDRAL.

105. W. S. WEATHERLEY, *Associate.*

106. MAURICE E

DRAWING (xxxvii)

Photo-Lithographed & Printed by James Akerman, 6, Queen Square, W.C.

.ADAMS. *Associate*

VI. ARCHITECTURAL DRAWING (xxxviii).

INK-PHOTO. SPRAGUE & Co. LONDON

107. EMMANUEL BRUNE, *Architect.*

(Grand Prix de Rome, 1863.)

PROFESSOR OF CONSTRUCTION AT THE ÉCOLE DES BEAUX-ARTS, PARIS.

VI. ARCHITECTURAL DRAWING (xxxix).

"INK-PHOTO", SPRAGUE & Co. LONDON.

108. R. PHENÉ SPIERS, F.S.A., *Fellow*.

VII.

ROOF COVERINGS. By Ralph Nevill, F.S.A., *Fellow*.

[Read 16th February 1885, Alfred Waterhouse, A.R.A., *Vice-President*, in the Chair.]

I HAVE no intention to attempt to deal exhaustively with the very large subject of roof coverings, but propose to confine myself to what I can speak to of my own knowledge and experience.

The particular form of roof covering of which I propose to treat is—Tiling. This and Slating may be said to share the whole of country roofing between them, while in towns there are strong competitors in zinc and lead, concrete and asphalte. Tiles may be said to stand above slates in the qualities of picturesqueness, durability and protection in temperature; while slates have the advantage in lightness, closeness of fitting, and, except in the case of the best qualities, of cheapness. The flatness of pitch of which slates allow is so inadmissible, in any of the styles founded on national examples—in any, in fact, except the pure Italian or Classic—that all saving of material nearly disappears. To withstand weather a roof of over 45° can hardly be made of less than 4 inches by 2 inches rafters, and therefore all saving in scantlings disappears, while the necessity of utilizing the high roofs for attics, and the consequent necessity of protection against heat and cold, finally almost disposes of what remaining difference of cost there may be, except in so far as cases of carriage are involved. There remains one great objection to tiles, and that is the impossibility of getting them to lay quite close. I speak of course of ordinary plain tiles and not of any fancy article.

In the autumn of 1880 occurred a great snow-storm, in which the snow was driven by a strong wind in the form almost of a dust storm. I suppose it is no exaggeration to say that there was not a single tile roof in the South of England through which this snow did not penetrate, leaving in some cases barrow-loads of snow on the ceilings below. This happened also in many cases in which the rafters were felted on the back, the felt having doubtless bagged and opened at the joints. The outcry was so great that it set me thinking if I could not find some plain practical way of stopping the mischief, and the process I am about to describe is the upshot thereof.

I should first perhaps describe the methods in ordinary use and the objections to them. The old traditional method of laying tiles is by hanging them over heart of oak laths by wooden pins, fitted to the holes. To make these pins was the winter occupation

of the bricklayer. The usual materials were willow and hazel, with a preference for elder, as the most durable wood, and a later employment of deal as the most accessible. These pins were troublesome because they had to be fitted to the tile holes, and the tiles were often broken in the process. Cast iron pins have now almost universally superseded the wood pins and are in every way preferable. The laths were nailed to the rafters; the consequence being that after a time, the lath split, and sprung off the nail head, and, as I have often found in taking off old roofs, perhaps not a single lath in a whole square was fixed to a rafter, the whole mass staying in its place simply by its weight.

A very great improvement in lathing is the use of a hook nailed on the bottom side of the lath and clenching it. This should, I think, always be used instead of a nail. The acid of oak moreover corrodes the nails driven in it. In counties away from oak growth heart of oak lath has long been supplanted by double fir laths. Where a roof is fairly dry and good old fir laths are used, I doubt if there will be much difference in the duration, but the life of a modern young-wood fir lath cannot, I think, be very long. Sawn fillets have to a great extent superseded the fir lath, but in these also the duration must depend on the quality of the wood, and it must be remembered that, as all tiles retain a good deal of moisture, there is likely always to be a certain dampness present about the laths.

The oldest and commonest method of weather-proofing the tiles, was to bed them in hay, which doubtless for a year or two had a good deal of effect in keeping the rooms inside warm, but nobody who, in taking off old roofs, has ever seen the horrid mess to which the hay in a few years becomes reduced, would ever think of adopting so useless and pernicious a method. Its use and that of straw are properly forbidden by the Ecclesiastical Commissioners, the Queen Anne's Bounty Office, and other well-known authorities. There is a plan allowed, however, to which there are some objections, and that is the pointing of the tiles from inside with haired mortar. This is of course only practicable for such parts of the roof as have no ceiling below them, and therefore fails to be of use in the larger number of cases, and those the most important. The objection is that, as all tiles hold a certain amount of water, and the free circulation of air round them is stopped, the tiles and their stopping get into a sodden state, which leads to the rapid collapse of the laths, &c. This applies still more to the bedding of tiles in mortar—a practice which is in consequence generally discredited. It is usual, however, in each square to bed a certain number of tiles in mortar to give support to the rest, and this is undoubtedly a point to be attended to.

I now come to the use of felt, the usual cure for all these difficulties. Of this there are various qualities, of which naturally the cheaper are the least satisfactory. I can only say on that point that the common roofing-felt is quite unfit for any but the commonest use, and that only some known quality from some respectable maker should be specified and used. There are various ways of applying the felt, the commonest being to strain and nail it to the backs of the rafters, and then to nail deal fillets over it down the backs of the rafters to which the tiling laths are nailed. The objection is that the felt very soon stretches and bags, and opens where one roll over-laps the other.

Such refinements as taking the edges off the rafters and joining the seams I have little faith in, for who is to see them carried out? As there is a probability of the felt becoming damp, there are also great objections to allowing it to wrap round the backs of the rafters, since rot is pretty sure to be set up. Sometimes the roof is match-boarded and felted with fillets and tiles as before, but objections apply equally that the boarding is found liable to rot. Moreover, the expense would quite forbid the general employment of this method. Another plan is to nail the felt on the underside of the rafter, and temporarily to keep it back from the plaster laths by springing laths in; of course it ultimately sinks on to the plaster laths, but the plaster is by that time so far set that no harm is done. If the workmen are not watched to start with, they will probably insist on nailing the felt elaborately to each side of rafter, or of fixing it with fillets—both of which are expensive and quite unnecessary. This plan does away with the fillets on the backs of rafters, as the tile laths can be nailed directly on the rafters; also the extra $1\frac{1}{2}$ inch thickness of the roof is saved, and that extra thickness is often rather troublesome to deal with. I rather prefer this plan myself, as it allows air to circulate round the rafters. Considerable trouble has often been caused by smell from felt finding its way into the house, even though it has been treated with the orthodox two coats of lime white. If any one be rash enough to use felt over match-board where there is no plaster ceiling, he will find this smell out to his cost. I fancy the general idea will be that the life of felt is not long, and that after some years it is worse than useless. We only reconcile our consciences to it in the lack of something better. It would be useful to hear the experience of any one who has stripped an old felt roof of, say, even ten years' date. With regard to asphalted canvas, such as McIlwraith's and Willesden Paper, my idea is that there is nothing much between all such substances in this position—a few years' duration at the most. They seem to me unfit for any position that is intended to remain untouched for ever.

It will be convenient to allude to the various fittings connected with tiling. Hips and valleys are most generally done with proper tiles, and it is so easy to get these made to any pitch, that it is not necessary to allude to the substitute of lead rolls or gutters. Ridge tiles, which may be had of any pattern, should be dowelled and set in cement, and it is most desirable that they should be fixed as the work proceeds. Dripping eaves are commonly fixed on a double tile, set on the eaves lath in mortar, and projecting about 2 inches. Other eaves, or as called with us barges or verges, are finished by bedding a tile flat, care being taken to choose straight tiles, along the edge of the outside rafter or the barge board. These under tiles are fixed by nails driven in and bent over them, the upper tile being bedded on them in mortar or cement. Very often a slate is used instead of a tile, generally in fact, if the builder be left alone, but the effect is not nearly so good. Where a brick wall runs up to the tiling the slate or tile will probably be bedded upon it, in which case my friend, Mr. C. H. Cooke, points out to me it is important that a bold fillet of cement should be run along the angle. During a big storm, a few years ago, a number of houses in Fitzjohn's Avenue had their eaves ripped up by the wind.

Where weather tiling comes under the tiling this fillet is necessarily present, and where a barge-board is present there is usually a moulding at the top that answers the purpose. Two inches may be considered the standard projection. There are two ways of finishing the barge: one is to rake out the joints and point neatly in cement, or much better still to set altogether in cement and rub in the joints, and the other is to face the edge of the tiles with cement. The advantage of this latter way is that you get a clearly defined white edge to your tiling, which is certainly useful. This edge is, however, so likely to crack and drop off that the other plan is to be preferred.

There is one point about hips to which I should like to call attention. I frequently see hips carried up to a point with perhaps a shaped ridge tile at the end; old hips in the south are seldom if ever so done—the two rafters nearest the centre of hip are separately fastened to an upright pair—the consequence is there is a little cock at the end of the hip, the ridge tile ends square, and the hip tiles are kept distinct from each other. The little gablet is filled with plaster with perhaps a bottle end. This plan is eminently sensible and constructional, and gives rather a knowing look to the hip. Haystacks for some reason are always finished thus.

A very important question is that of flashing. I have tried several ways but confess I have been unable to find anything to supersede lead, the more especially as it is most desirable, where brick chimneys are used, to connect the flashing with a course of lead soakers built into the chimney. One may have the lead dressed down on to the tiles or arranged in a secret gutter underneath. The latter plan is, I confess, an abomination to me, suggesting suspicions of leaves, birds' nests and stoppage, and one's eye so soon becomes used to the visible lead as to resent its absence when concealed.

I will now proceed to explain the method I have, for the last four years, adopted and I may say that it is no mere suggestion, but has been in practical use for those four years, during which over 500 squares have been laid under different builders, and by ordinary country workmen as well as London men. In no case at present has any difficulty arisen, but it is, of course, impossible to say anything about the test of time or any evils that may eventually develope themselves. Briefly, I cover the backs of the rafters with a 1-inch coat of concrete or plaster, in which the pins of the tiles are fixed—the process being as follows. First cover the rafter with single fir laths, as if for plastering. As the laths are only required while the concrete is unset, there is no object in using double laths. Three-inch rose nails are then to be driven into the backs of the rafters, at whatever distance may be the gauge of the tile—say $3\frac{1}{2}$ inches; the exact distance is not material, but there should, I think, be about one nail to each course of tile, and care should be taken that these nails are out of the line of the tile pin. Probably it would be better to use nails treated by the Bower-Barff process, specially made with a stop shank, to prevent the necessity of gauging. These nails are to be left standing, above the backs of the rafters, one inch. A concrete plaster is now to be made up. For this I employ selenitic lime; my experience of this is so satisfactory that I never use any other for ordinary building. The difference of cost is, in Surrey at any rate, very trifling indeed, and as I find that some of my builders employ it on their own account for all winter

jobs I conclude they find their profit in it. One of its great advantages is, that it mixes homogeneously with Portland cement—and I at first used a mixture for the roof concrete. Experience, however, makes me prefer the simple selenitic. What is essential is to use a lime or cement that shall set very hard, carry a hard surface, and also not set too quickly. With this lime I mix about four parts of clean engine ashes or coke breeze, with a certain amount of clean sharp sand; this is worked up into a mortar and laid on the laths, in one coat about $1\frac{1}{4}$ inch thick from the back of rafters, so that the heads of the rose nails are quite imbedded in the concrete. One chief object in using ashes is to lessen the weight of the material, and it is needless now-a-days to point out what strong work ashes make. I have a fancy a little sand improves the mixture, but am not prepared to assert it positively; perhaps if a mixing mill were used there would be no occasion for it. Either coke breeze, engine ashes, or the ashes from greenhouse stoves, or some clean variety, can generally be obtained without much difficulty—but in some cases, where cheapness was essential, I have used plain sand. In laying the plaster care must be taken not to lay more than can be worked on in a day. I generally find that plaster laid overnight is ready for working on in the morning, or in hot weather, that if laid in the early morning, it may be worked on in the afternoon. As soon as it is sufficiently set it should be trowelled over to such a surface as may be easily managed, but, doubtless, the smoother and harder the better it is, and it is in this that I think a proportion of sand is useful. The plaster being sufficiently moist to receive, and yet retain the pins, the tiles may next be laid, the pins being pressed into the plaster. It is as well to suggest to the tiler that he should protect his thumbs with a leather glove, stall or shield: odd as it may seem, I have found they constantly do not think of this for themselves, and are in consequence found grumbling about their thumbs. The tiles are lined by a snapped chalk line, to which the bottoms are set; there is a little extra work in this, but great regularity of line results. The tile pins should be only $1\frac{1}{2}$ inch long, and not the usual 2-inch size. These can be procured ready made at some places, or can quickly be had to order. They should cost rather less than the 2-inch, being sold by weight. Of course two pins can be put in each tile, an advantage as, whatever may be specified and insisted on in lath tiling, it is rarely, from the irregularity of the tile holes, that the second pin has any bearing. One of the difficulties of the process is the scaffolding for workmen; of course there is no hold between the plaster laths, so that the work has to be done from a plank fixed on bags and slung over the ridge. I never found the men make any difficulty about arranging that for themselves, nor have had any case of the tiling being injured by the cradle being drawn over it.

I began by limiting the amount of plaster worked on at once to long horizontal strips three feet wide, fearing lest the accumulated weight of more wet material should drag and slide when worked on; but in practice I find one need not trouble about this, as the laths prevent the concrete from sliding on the rose nails, and enough cannot be laid in a day to involve danger. It is desirable to insist on the tiles being laid while the plaster is fairly soft, as otherwise the men will be found putting the pins in with a hammer, of course spending more time over it. When they find that the other plan works, they

readily adopt it; indeed, I have been much encouraged by the readiness with which workmen, generally very conservative in their work, have taken to the system, and the cordial approval with which they have been good enough to receive it. Should, however, the plaster have unavoidably been left some time before being worked on, it is easy enough to put the pins in with a hammer. The eaves lath will require to be $1\frac{1}{2}$ inch thicker than usual in order to stop the plaster; the valleys are of course finished in the plaster, and it is as well to trowel them a little more carefully. The hips want a roll or raised piece forming on the angle, to take pins; and where the roof abuts on chimneys, &c., the thickness of the plaster is easily increased so as to tilt the tiles from the wall. Where there is a base to the chimney, a chase may with advantage be cut under which to house the plaster. The barges require a strip of wood $1\frac{1}{2}$ inch thick to the back of rafter, to which to make good, or, where a barge-board is used, it may be fixed higher than the rafter to answer this purpose.

It will be seen that, the roof being complete, you have a solid $1\frac{1}{4}$-inch coat of concrete all over, kept in its place by wrought nails, and also by the eaves lath, and independent of the decay of laths. The surface, being hardened and glazed by the trowelling, will throw off any wet that may penetrate through the tiles, and of course neither snow nor wind has any chance of passing through. The coolness of rooms covered in this way during the hottest summer, is remarkable, and I have myself tested it repeatedly. Of its warmth in winter I cannot say so much personally, although I am assured by some who have lived in the houses that that also is quite satisfactory. The concrete being made with ashes would, I think, ensure greater warmth than if it were made of broken stone. The tiles being laid without anything in their joints, the air has a chance of circulating round and between them, and all over the top of concrete, thus allowing any wet that soaks into them to dry out. I have here two samples of the concrete, just such as was used for the roofs. The first, "A," which is three years old, contains a certain proportion of small, broken Bargate stone; this added to the weight, and got a little in the way of the pins, and I have discontinued its use. The other, "B," is about two months old. The surface of both is undoubtedly smoother and more finished than it would be on the roof without special pains. The ashes used here are ground clinkers, and are therefore very much heavier than coke breeze or house ashes.

It is quite possible indeed easy, where desired and advantageous, to omit the plastering of the underside of rafters, and supply its place by a thin coat applied to the underside of the laths that are on the outside. This should be done while the outside concrete is moist, so that the two may be thoroughly incorporated. I have constantly done this inside verandahs where wrought rafters were desired, also behind barge boards, and in outhouses where there was no objection to plain rafters. Also, I think it would be quite possible to put the rafters further apart, as the bearing becomes so uniform, and the concrete, when hard, will carry itself and tiles. I have in several cases put the rafters of verandahs 1 foot 6 inches apart, but I do not suppose it would be wise to vary the standard width apart of house rafters. That such an outside covering would be a great protection against the rapid spread of fire in roofs is of course obvious and worthy of note.

The objections that may be raised seem to me to be these: The increased weight. I have not found it necessary to make any difference in the scantling of timbers—4-inch or 4½-inch by 2-inch rafters, with halved collars, uprights and purlins, according to size of roofs, are quite sufficient; and one can hardly, in any case, do with less. Of course, rigidity is desirable, or the plaster would separate into various pieces; but even in that case the rose nails and its own weight would keep all safe. It must be remembered, too, that the weight is very equally distributed. One-foot hollow walls, with occasional buttresses, I have found quite sufficient for such buildings as stables, &c. The next and most obvious suggestion is that the timbers will decay for want of ventilation, being enclosed between the two coats of plaster. At first I had my roof timbers treated by Connor's process and Sir William Burnet's, but I have given up the idea that it is necessary. Two sides of the rafters are unenclosed, and sufficient air will, I think, find its way through the plaster and under the eaves, and from above the collars, to prevent any danger. If the outside coat were to become sodden, there would undoubtedly be danger; but in the event of its being properly trowelled and mixed, I do not think there is much fear of this. Otherwise, the timbers are only in the position of partition studs. A coat of tar might be run along the back of rafters. The next important point is the question of relative cost. I have in several cases had the labour and materials carefully taken out for me, and I take the following as the standard per square. I leave out the prime cost of tiles, as that is the same in all cases, and must vary with the locality. The other prices I take from Laxton's price-book, not because it is necessarily correct, but because it is a convenient standard to which to refer.

TABLE OF PRICES FOR ONE SQUARE OF TILING ON CONCRETE.

QUANTITY.	RATE.	AMOUNT. £	s.	d.	RATE.	AMOUNT. £	s.	d.
Labour.								
Plasterer 2½ hours	at 10½*d.*	0	2	2¼	8½*d.*	0	1	9¼
Labourers 10 „	„ 7*d.*	0	5	10	5*d.*	0	4	2
Bricklayer 12 „	„ 10½*d.*	0	10	6	8½*d.*	0	8	6
Labourer 12 „	„ 7*d.*	0	7	0	5*d.*	0	5	0
		£1	5	6¼		0	19	5¼
Material.								
Single fir laths 2½ bundles and nails	2*s.* 3*d.*	0	5	7½				
3 inch rose nails 300	6*s.* 6*d*M.	0	2	0		0	14	4½
1½ inch tile pins 1400		0	2	9				
Concrete 12 bushels as below... ...	4*d.*	0	4	0				
		£1	19	10¾		£1	13	9¾

1 bushel	Sel. lime	1*s.* 0*d.*
3 „	screened ashes	6*d.*
1 „	sand (& water)	2*d.*
5 bushels		1*s.* 8*d.*

The value of ashes and sand, of course, varies very much, and the cost will be proportionally affected. The chief extra cost, however, is in labour, and the extra at country will therefore be a good deal less than at town prices.

TABLE OF PRICES OF ONE SQUARE OF ORDINARY TILING.

	£ s. d.	
Plain tiling—$3\frac{1}{2}$ in. guage labour and mortar ...	0 12 0	0 9 4
Heart of oak lath and nails and labour	0 8 10	0 8 10
	1 0 10	0 18 2
Asphalte felting	0 11 0	0 11 0
Battening $1\frac{1}{2}$ in. by 1 and 15 in. apart	0 6 8	0 6 8
	£1 18 6	£1 15 10

In practice I allow fifteen shillings a square over the price of plain tiling on heart of oak lath (the latter about equivalent to sawn deal lath.) This price has always been accepted by the various builders without demur, so I suppose it may be accounted as sufficient; were workmen to get thoroughly and generally used to the process, it should I think be done for less.

The system is likely, I think, to prove extremely useful for the employment of the various kinds of large tiles such as Pantiles, Poole's Roman tiles, Broomhall tiles and Phillip's lock-jaw tiles. Great difficulties have occurred in the use of some at least of these tiles, from the fact that the thicknesses not being doubled, the rain often comes through them in exposed positions. Moreover, there not being the same thickness, the same protection against temperature is not given. If they were laid on this system, any wet soaking through would be arrested by the concrete and, where appearance allowed it, there would be a distinct saving on the unnecessary bulk of the plain tiles and the labour of laying.

I see no reason why the same system should not be applied to slating, the substitution of a concrete mixture for boarding being, it appears to me, much to be desired. If wood strips to receive the necessary nails were introduced, it would also I think be preferable to boards in the cases of both lead and zinc roofs or flats, or under corrugated iron; but in these cases the thickness might be less, and 7 parts of ashes used to 1 of lime. I may say, also, that I have used it under stone tiles, for which purpose it is very well suited, although in the particular instance the old oak rafters being very wide, the slabs were nailed through into the rafters.

RALPH NEVILL.

[Remarks by William George Coldwell, *Fellow.*]

Roof coverings having been proposed as a subject for discussion, it occurred to me that it would not be out of place to allude to the very strong impression recently left on my mind on the want of security of plain tile roofs. Fortunately in this country earthquakes are of very rare occurrence, but it will be remembered that on the 22nd of April last we had a visitation of one of these convulsions of nature, the greatest disturbance from which appears to have been in the county of Essex, south of Colchester.

About a fortnight afterwards, from motives of curiosity, I visited the district, going southward from Colchester as far as the channel dividing Mersey Island from the shore and from west to east over the country between Pelden and Wyvenhoe—this area may

be roughly stated at about forty square miles. The most significant impression left on my mind from this superficial survey was the want of security of plain tile roofing. Many of these plain tile roofs appeared to be completely stripped—contiguous farm buildings were entirely uncovered; they had evidently come down *en masse*, and there were satisfactory proofs that I saw these roofs as the earthquake had left them.

The action of this earth-wave has been generally described as that of a twist. My driver told me he was on his box at the time and was " almost twisted off," and the same twisting action was alluded to by the hotel waiter in Colchester. It is true that the action was of such force as to throw down chimney-stacks and many brick gables, and, in three instances, the parapets from church towers, but taking all into account, there still remains the strong impression of the generally ruinous condition and consequent want of security of plain tile roof coverings.

Among other roof coverings occurs lead, and there is not a more important subject for professional remark than the deterioration in the quality of lead as now supplied.

About fifteen years ago, when some trifling repairs were in hand on a lead-covered roof over a large and important building, it was found that the underside of the lead had attached to it in various places a whitish grey powder. This, on being submitted to a chemist, was declared to be white lead, and hence resulted an examination of the entire roof. This, an open timber roof, has internally oak boarding, and upon it to receive the lead there is the usual deal boarding. It was found that a film of white powder was attached to the underside of the lead, in lines corresponding with the joints of the boarding, indicating injurious action from below. The chemist applied to in this case was Dr. Frankland, and I am permitted to lay before the Institute the details of his Report, than which I do not think it possible to have a more comprehensive or important document on modern lead. I must, however, state that I have not the report now before me, and am only presenting what I well remember of its substance.

Dr. Frankland, on being furnished with samples of the lead which formed the covering of this roof, submitted them to chemical analysis. In his report, after alluding to the well-known fact that lead ores contained silver, he stated that, previous to the year 1840, this was removed by a crude process, and that the quantity left in the then ordinary lead of commerce was from 12 to 15 ounces to the ton. In the manufacture of white-lead, the first process was to free the lead as far as possible from this silver, in order that the acid might the more freely act upon it. About the year 1840, however, a process of de-silvering was introduced, by means of which the silver was removed to such an extent that the lead supplied to the plumber contained only 2 to 3 ounces to the ton.

Dr. Frankland found that the lead on the roof, although laid at a period so closely upon the time when this de-silvering process was introduced, had been submitted to the modern practice—it contained the least amount of silver to the ton, and, consequently, was the more readily acted on by acidulated vapours. I may state that I have seen an instance where lead which had been laid on a flat only a few years previously has shown evidence of injurious action on the under surface.

This flat I saw constructed over kitchen offices in the North of London by one of

the first building firms, with every attention to constructive detail except the one to which I wish to call attention. It was thoroughly well put together, and when completed was, with respect to the space between ceiling and lead, hermetically sealed. On these kitchen offices being enlarged, three or four years after they were built, the lead was turned up, and our old enemy the grey powder was found as a coating on the under surface. In extending this flat the course taken was to insert air bricks under the original flat as well as under the extension, in fact to use the same precautions for introducing a current of air under the lead for its preservation as you would under a boarded floor for the prevention of dry rot.

On the different methods of covering Iron roofs, apart from the ordinary purlins and rafters, we have wrought iron laths of angle iron extending from truss to truss, to which slates are hung by a couple of nails of the ordinary character. We have also, as used over a Retort House at the City of London Gas Works (recently taken down), the slates secured to the angle iron laths by *lead* nails, about the thickness of a tobacco pipe which could be easily bent by hand round the laths.

In order to secure a wood covering to an iron roof, we have two modes. At the Great Northern Railway Station in Maiden Lane or York Road, now the Potato Market, the rafters are formed with two thicknesses of wrought iron, having between them a deal strip 3 inches by 1 inch at the top, and 3 inches by 3 inches at the shoe, to which is nailed the slate boarding. The Duke of Wellington's Riding-house has a roof of similar construction, but with the wood strip $1\frac{1}{2}$ inch thick throughout its entire length. In the roof over "Tattersall's" the rafters are of T iron, with a $1\frac{1}{2}$ inch deal board screwed to the top table, upon which is nailed the boarding for slates. In a roof designed for a barrack in a tropical climate this latter principle was adopted. In this case, as a protection against destructive insects, the wood used was pitch pine, the covering $1\frac{1}{4}$ inch thick ploughed and tongued, upon which was spread a layer of asphalted felt secured in the boarding by 3 inches by 1 inch slate battens also of pitch pine, giving additional rigidity to the boarding, and of course introducing an air space between it and the slates.

WM. GEO. COLDWELL.

[Extract from the Report of a Tour in North Germany by Hugh McLachlan, *Associate*, as Holder of the Godwin Bursary, 1883.

Tiles.—All the old timber-framed buildings of Hamburg are roofed in with pan or plain tiles. The old buildings on the Mühlendamm (milldam), Berlin, have their roofs covered with plain tiles, and other old buildings, with Mansard roofs of the last century, are likewise covered. A large number of the older buildings are roofed with plain tiles in double courses, the tiles being rounded at their lower ends. The church of St. John, Altona, is roofed in with plain tiles of varied colours, laid in patterns ; it also has pinnacles covered with glazed and coloured tiles, similar to the facing bricks. I believe the spire was also covered in this manner, but it had not proved perfectly satisfactory. The new church at Wedding, Berlin, is also roofed with plain tiles, of a whitish red colour. Many of the private new buildings at Halle have plain tile roofs, the tiles having varied tints, and laid in patterns. The German tiles are 4 to 5 inches longer than ours.

Slates.—Slate has, I believe, been only introduced as a roofing material into many towns of Northern Germany during the last fifty years ; this is the case at Berlin, and I did not see an old

example of this kind of roofing in any of the towns I passed through, so far as I can remember. The oldest example I have noted is at the Municipal Hospital, Dresden, where the pavilions, kitchen-buildings, boiler-house, wash-house, and part of the out-building, are thus covered. At Hamburg, the sloping parts of the roofs over the new Courts of Justice (not the prison), and the new Schools, Am Borgesch, St. George, were covered with Welsh slates laid directly on the battens, there being no boarding or felt between those and the rafters. The roof over a pretentious private building in the Mohren Str., Berlin, has the slope next the street divided into bays by vertical rolls of lead, or similar material. These bays are covered with slates, laid in ornamental patterns, and so cut as to show over all regular hexagons ; the slates are of a blue and green colour, and many of them are gilt over. The sloping roofs over the cattle and sheep stalls at the Central Cattle Market, and over the boiler-house and engine-house of the Polyteknicum, both of Berlin, are covered with Welsh slates, laid in the English manner ; and this is now pretty general in that city. The German mode of laying slates is in oblique courses, similar to that seen at the Law Courts, London. It is not necessary that all the slates should have the form of a parallelogram : the outer angles are often rounded, and the topmost ones may be broken off ; neither need the slates all be of the same size, as in our English mode. The slates used are generally rough and thick, of small size ; these are sorted before laying, and the largest laid at the bottom of the slope, the sizes decreasing as they reach the ridge and apex. These are always laid on boarding. By this method slates can be used that would otherwise be useless ; it appears to have come from the Rhine Provinces, and is now much used for the steep slopes of turrets, &c., in the large new buildings at Berlin and other places, built in the German Renaissance style. Other buildings that I may mention, as roofed with slates, at or near Berlin are—the buildings of Friedrichshain Hospital ; the buildings of Tempelhof Garrison Hospital, with the exception of the Pavilions, Economy-block, and the Ice-house, are covered with English (Welsh ?) slates, laid on boarding in the English manner ; the buildings of the Moabit Courts of Justice and Prison, with a few exceptions ; the wood pavilions of the Charité Hospital ; and the Germania building in the Friedrich Str., which last has a Mansard roof, and the slates are of two colours, laid in patterns.

Copper.—Till this century copper appears to have been generally used for roofing public and monumental buildings of the first class, especially spires and domes. Instances are the upper parts of the towers and the spires of the churches of St. Michael and St. James, Hamburg, of the parish church at Altona, and of many churches and buildings at Berlin, Dresden, and Halle, which I observed but did not note. The old parish church at Altona has a flèche covered with the same material, also the dome of the castle palace, over the chapel, and the roofs of the old and new museums at Berlin. For more recent buildings it has been used to cover the spire of St. Peter's Church, Hamburg, rebuilt after the great fire of 1842, also the cupola of the men's prison at Moabit, and for the gutters, flashings, &c., of the roof of the new Courts of Justice, Hamburg, the last two being very recent works. I believe also that the roof-covering of the colonnade round the Column of Victory, Berlin, is of this material. It is, therefore, still used for important work, and the supply at Berlin is drawn exclusively from England.

Roofing-paper.—I noticed the following buildings so covered :—The flat of the roof of the new schools at Am Borgesch, St. George : in this the paper was fastened to the boarding in horizontal sheets, with copper nails ; the coal-stores and open store-shed at the Dresden Municipal Hospital ; the barrack pavilions at the Moabit Hospital ; the barrack pavilions at the Leipzig Hospital : these last two have wood fillets at the joints, between the ridges and eaves, which are also tarred over ; and the buildings generally of the Central Cattle Market, with the exception of those covered in with slates ; for these last buildings the paper is laid double.

Wood-cement.—This, though a recent invention, is now one of the most important, roofing materials in North Germany, and it would appear to be in a fair way of superseding every other, except in those cases where steep or arched roofs are required for artistic effect. The material was invented by the late C. S. Häusler of Hirschberg, Silesia, forty-four years ago. Its use was at first confined to that province, since which it has been introduced into Berlin and other towns, and during the last twenty-years it has gradually become more of a favourite amongst roofing materials. The name is a misnomer, since properly speaking it has none of the hardening properties of cement, neither does wood to all appearance enter into its manufacture. The roof surface with wood-cement roofs has only the small slope of about 1 in 20. The roof has a stout grooved and tongued covering of battens, laid so closely that a shell is formed ; this is covered with a layer of fine sand one centimetre or nearly half-an-inch thick. This layer

of sand is then covered with strong paper in rolls, by which the individual sheets are stretched from the eaves on one side to the ridge, and continuing over that to the eaves on the other side. The sheets of paper, about 4 feet 11 inches wide, are laid dry, and in such a way that the borders overlap each other at the sides for about 4½ to 6 inches; the sheets of paper are only fastened at the eaves lightly, by means of nails. This bottom layer of paper is covered by a coating of wood-cement, rendered liquid by warming, with large brushes, about 1-25th of an inch in thickness; then a second layer of paper is laid down, so as to cover joint. Proceeding in this manner four layers of paper are laid one after the other, over the roof surfaces, with coatings of wood-cement between the layers, when the upper layer also receives a thin coating of the wood-cement. The bordering stripes 4 to 4½ inches wide, where the sheets overlap, have an extra fastening by a coating of wood-cement between. It is to be observed, that the coating with the cement should be done as quickly as possible, also the spreading out of the paper sheets must be effected very quickly without any foldings, so that an inner sticking together of the paper by the cement should not happen. Further the paper to be used must be well sized, so that the body of the cement shall not be beaten through it. Over this is strewn a further covering of gravel 2¾ to 3 inches thick, the lower part fine grained, and the upper a coarser screened gravel, at times with a small addition of powdered loamy clay. The roof is then finished with the exception of finishings at the eaves and ridges, unnecessary to be mentioned here. It is found a good plan to grow turf and even small plants on the roof, as it has been found that the durability of these roofs is not so good, if the gravel layer is liable to be blown away—the oily particles of the preparation being better preserved thereby, that being already the case when compared with ordinary tar. Roofs so covered have already lasted during the life of a grown man; and the only disadvantage of such covering is that the roof construction beneath must be pretty stout, which makes them somewhat expensive. Care must be taken to provide ventilation for the roof timbers from below; the cost of maintenance is small, and the keeping of an even temperature beneath them is very satisfactory. This material has been used in the following works:—the new Courts of Justice, Hamburg, for covering the flat part of roof; Dresden Municipal Hospital, for the roofs over the connecting corridors and a recent out-building; nearly all the buildings of the Rummelsburg Workhouse, and of the Halle University Medical School and Hospital, excepting the few covered with slate and some low buildings of inferior character; the Pavilions, Economy-block and Ice-house of the Tempelhof Garrison Hospital; the buildings of the Imperial Printing Establishment, Oranien Str., Berlin; and the new Ethnological Museum, Berlin, is also to be covered in with it; also numerous other buildings. In the buildings of the Garrison Hospital thus covered there are no ceilings below the roof; the rafters are covered on the under side with double reeding and plaster, a pugging of loam and straw being between the plaster and the boarding of roof, provision being made for ventilating the timbers between the pugging and the boarding. The roofs over the Imperial Printing Establishment are laid without timber work or the isolation sand bed, the paper being nailed to porous bricks carried by corrugated-iron and iron girders; a similar system is being adopted at the Ethnological Museum, Berlin. Building-inspector Herr von Tiedemann says in a small work on the Halle University Medical Schools and Hospital, when speaking of the Surgical Pavilions, "The roof is a wood-cement roof by Häusler; "this construction has been much preferred in the newly-built University Institutions, and has in every "case exceeded expectation." The experiment carried out in the Pavilions of using the wood-cement roof without the further addition of a bad heat conductor, at the same time as roof and ceiling, has been perfectly successful. The roof has neither a pugged floor nor a lined ceiling below it, and in spite of the open situation of the Pavilions, which are protected by no high neighbouring buildings, the temperature has never risen too high on the hottest day of two successive summers. It may be added that it is considered to be one of the most fire-proof roofing substances, and it can be finished in Berlin from 2/1 to 3/1 per square yard; the cement is also sold by the barrel.

HUGH McLACHLAN.

*** In the Discussion of this Paper a description was given by Alexander Payne, *Fellow*, of concrete roofs (see his Paper thereon printed in *The Builder*, 21 Feb. 1885, page 263), and he advocated the use in this country of cement concrete for iron roofs as well as iron floors, just as plaster is used for similar purposes in Paris, and other parts of France.

VIII.

THE USE OF FLINT IN BUILDING, ESPECIALLY IN THE COUNTY OF SUFFOLK. By Frank T. Baggallay, *Associate* (*Ashpitel Prizeman*), Gold Medallist of the Royal Academy of Arts.

[Read on Monday, 20th April 1885, Ewan Christian, *President*, in the Chair].

LET me remark, by way of preface, that for obvious reasons I cannot bring to bear on my subject the results of ripe experience or of long study. I am not even a specialist, and could not, if I would, lay before you a complete diagnosis of any great practical subject, nor would I, if I could, dive into deep utopian or archæological speculation. I should not indeed dare to address the Institute at all but for the confidence which I have in my subject, and the certainty I feel that it must prove of some little interest to many, however indifferent may be the manner or language in which it is brought under notice, or however slight the information I can supply. If I am but able to show that it is worthy of being taken up and sifted by some man with capacity and leisure for the thorough study and elucidation, which I at first intended and have since vainly endeavoured to give it, all will have been accomplished that I expect to do.

The subject was first suggested to me by a visit to the picturesque city of Norwich, with its splendid old churches, all—or almost all—partially or wholly faced with flints, the use of which, in the churches and other buildings in the eastern counties, has often been alluded to in accounts of tours and visits to the neighbourhood, and in archæological essays, but does not seem ever to have been treated with the fulness it deserves as a great and essentially *English* peculiarity, especially in its later developments.[41] I trust, therefore, that it is not presumptuous to hope to find some fresh interest in the subject.

Such interest chiefly centres in the flush tracery and panelled work which is so universal a decoration of the fifteenth-century churches of Norfolk and Suffolk; and, as this kind of decoration is essentially superficial, you will perhaps forgive me for attempting to forestall the sweeping condemnation of it on that ground, which I am in

[41] The fullest references are to be found in the *Dictionary* of the Architectural Publication Society, article "Flintwork;" The Reports, etc. of the Associated Societies, vol. i, a paper on the "Peculiarities "of Norfolk Churches;" *The Builder*, vol. i, p. 605; and *Archæologia*, vol. xii, p. 178.—F. T. B.

terror of hearing from some quarters. It is only a very few years since we were accustomed to be told that unless a wall were of similar material throughout it was a sham; to build it of one material and face it with another was to tell an architectural, but unpardonable, untruth. Gauged brickwork shared with stucco and whitewash the anathemas which were very properly launched against the 2-inch paving stones on edge which sometimes do, or did do, duty for ashlar. It was even gravely assumed that, when a man sees the outside of a wall to be of red brick, he concludes that the inside is red also. Now, the very essence of an untruth is that it should deceive—or at least be intended to deceive, but we do neither when we clothe the more unsightly mass of the wall itself with a decent coat of some beautiful, and perhaps delicate, material which is quite inapplicable to rougher uses. Do we suppose, when we see a man with a broadcloth coat, that his shirt is of broadcloth too? If we carried the theory to its legitimate conclusion, must we not be content with bare brickwork in our rooms, lest some idiot should suppose that the pattern of our delicately-stencilled frieze extended through the wall, or at least that the latter was of plaster throughout? If we consult nature, does anyone who sees a green meadow, jump to the conclusion that the earth is a ball of grass? or could any but an infant think that the silver bark of the birch extended to the heart wood, or that a sheep was a bundle of wool?—the theory of sham in this case is surely only affectation.

But I fancy I hear someone say: "You are arguing against an objection to composite walls which never existed except as a theory and among very young men. Our objection as practical architects is, that it makes unsound work." To this I answer, that of course if I pretend to build a 14-inch wall, and make it up of nine inches of one material and four-and-a-half inches of another one in which there are fewer or finer joints, I shall only be rightly served if it settle unequally and quickly fall to pieces; but I do not recommend such a proceeding. What I would like to see is, the wall built independently, of a proper strength and thickness, and the facing added as an architectural decoration, proper ties to hold it having been left projecting from the wall. To this method I can conceive only one objection—that of cost; against which I urge that it would be quite easy to effect a great saving in the wall proper by using concrete, at any rate in the walls of monumental buildings, of which alone I am thinking. To its use for ordinary domestic work there are other and distinct practical objections. Every brick or stone represents the price of much skilled labour in its preparation and putting in position, to which must generally be added the cost of carriage, whereas concrete can be mixed of materials found anywhere, and can be made and used by anyone, with no more supervision than must be given to brickwork; and, as its use in walls becomes more general, I am persuaded it will become less costly. This question of cost as between concrete faced with brick, for instance, and solid brick, is very much one of the thickness of the wall required, and I do not recommend the adoption of the former to "speculating" builders. But for our great monuments, is it not worth considering whether we cannot by such means save our skilled labour inside the walls, without in any way decreasing their stability, and put it where it can be seen? Or, in other words, spend some

of the labour we now waste in doing a thing one way which could be done as well and more easily in another, on artistic decoration? But I am getting too far from my subject,—for an eloquent defence of surface architecture I need only refer you to Mr. Ruskin's *Stones of Venice.*

To return. Flint is one of the hardest and most durable productions of nature; indeed, being chemically nearly pure silica, it defies time, weather and hard usage, and is in itself practically indestructible. The advantage of such a material for monumental buildings is obvious, and were it only possible to obtain it in large well-shaped pieces, and—which is really the crux—to work it when obtained with reasonable facility, it would, for many purposes of building, beat all other materials out of the field. But we have to accept it, like the rest, as it exists, and with its natural limitations; and so we find it intractable and, except in a rough state, rather expensive.

Flints when regularly quarried are found chiefly in the chalk and are of *comparatively* large size, regular form, and even texture; but the small ones commonly used occur in many other geological formations, particularly in gravel and alluvial soils; they are found either scattered or in masses, or in beds and veins, and vary in the colour of their fractured surface from mottled white or brown to pure translucent blue black. It must not be supposed though that the white and brown flints seen in buildings were always originally so; or that the beautiful varied tones of the walling are in all cases due to any feeling for colour on the part of the builders; I believe that more often they are black or grey stones faded; it often happens too that the work gets a whitish appearance from the growth of lichens upon it. These small flints vary in size from a foot (which, however, is unusual) downwards, a very large majority being between two and five inches in their greatest dimensions, rugged and often grotesque in form. The origin of flints is still, I believe, more or less a mystery; some call them petrified sponges, but their lines of fracture seem to point to the deposit of the material round a nucleus which, in freshly dug specimens, is often found to be quite moist.

This is not the place to speak of the flint implements and weapons of our prehistoric forefathers further than to point out how remarkably the durability of the material is exhibited by objects buried, often in moist places, for unknown centuries, and exhumed with their chipped edges as sharp as when they were aimed at the awful mammoth that slew their puny and too venturesome owners; neither have I anything to do with a similarly warlike use of the material in times well within the memory probably of many present, I mean for gun-flints, except to recall to your recollection what has often been alluded to before, namely, that to the skill acquired in cutting them is probably due the greater excellence of the guaged flint facings used in buildings erected after their preparation became a regular manufacture. I will confine myself strictly to the use of flint as a building material.

There are several different purposes to which flints have been put, and different ways in which they have been treated in buildings: first they may be mixed with mortar or cement and used as concrete; the body of many old walls, faced with the same material treated in other ways, was probably made of such concrete. Secondly, they may be built

up as they are gathered, and without any preparation, into rough rubble masonry, such as we see in the buildings of all periods, from the early Norman or, as some say, Saxon round towers to the latest Perpendicular churches; or picked in sizes and roughly coursed, as seems to have been very much done in the earlier Gothic periods; and in both these kinds of work broken flints are often introduced, as well as pieces of softer stone of various tints, tiles and even bricks; the object, sometimes, evidently being to give colour to the walls; and in many churches near the coast flatish pebbles from the shore are found laid in a sort of herring-bone pattern. The next step is to break the flints and use them either in courses or otherwise, the former being much more usual, practical and artistic; it is very remarkable how the lack of the regular horizontal lines produced by coursing the work spoils all breadth of effect. For facing only, a further improvement is to split the stones with greater care, so as to obtain a fairly even surface, and to knock the white coat off them; then, in all the best late work, the splinters or flakes made in preparing the material are stuck into the joints, which are of course unavoidably wide ones, as thickly as they will stand; possibly with the object of wedging-up the work, or to lessen the body of mortar, which, owing to the flint being non-absorbent, takes a long time to indurate, but more probably to get as even a black surface as possible; this is called galletting,[42] and the cunning way these flakes are used, in most of the Norwich churches, in particular, where they are made to fit into and overlap one another so as to fill every chink, is very remarkable. Roughly dressed blocks of freestone are frequently built in with this random flint facing, and often at regular intervals, forming a sort of pseudo-diaper; their object, originally at least, must have been to form ties for the facing; they probably suggested the chequer work so common later on. A few instances are to be found of a close resemblance to a chequer pattern even in this rougher material, produced by carefully alternating a flint and a piece of freestone in each course. And rough patterns were formed with it by the introduction of brick diapers, as in the old Bishop's palace at Norwich, a piece of work clearly dated, in the brick itself, 1595.

Coming to the guaged flintwork: it, also, is of course only a facing material, and may be used in most of the different ways in which any other such material is used, but the great difficulty of cutting it suggested, or in all probability did so, that it was worthy of being set in a frame-work of stone. I have devoted so much of this essay to the description of works executed with guaged flintwork that it is unnecessary to do

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[42] In the discussion that followed the reading of this Paper, a great authority called this statement, that "galletting" was a mediæval practice, a heresy. On reference to the note-book which I carried with me in Suffolk and Norfolk, I find, in more than 20 instances, the remark "the joints in the facing are "carefully filled with chips," or similar words; one of those instances is that of the ruined church of Walberswick, in which there can be no question of restoration, while in three or four other cases I have added that the portion of facing examined was original, a superfluous remark, for I was always careful on the point. This only represents a small portion of the evidence I might have collected, for it was not long before the practice presented itself to me as too common to be worth noting. In support of my opinion, that of the author of a "Paper on Masonry," in the *Ecclesiologist* of August 1846, may be quoted. He says:—". . . I would contrast the absurd modern plan of using black mortar . . . with the old way "of 'garretting' flint-work, that is, of inserting small flint-shivers in the mortar of the joints."—F. T. B.

more here than call attention to the shallowness of the facing and consequent bad construction of the old work. I have been fortunate enough to find some very dilapidated examples—fortunate because of the opportunity thus afforded of seeing more of the construction. In most of these cases the facing has peeled off bodily, seeming to show that it was built separately, and not at the same time as the body of the wall, and I may mention, too, that in some cases the colour of the mortar in the facing is different. In one instance, at least—namely, in the tower of St. Peter-Mancroft at Norwich—so great was the mass of mortar between the rough rubble and the squared stones, and so shallow and conical were the latter, that, for a minute, I was under the impression that I had made a grand discovery—namely, that the mortar had been rendered over the wall, and the flints afterwards pressed into it. The idea is, no doubt, absurd; but after all that of building up such wafers on their edges is hardly less so.

Some of the earliest flint buildings in this country are the round church towers, about the origin and date of which there was so much logic chopped and ink shed some few years ago. It would take a learning which is not mine to throw any light upon the controversy.[43] All that I have noticed about them is, that the stones are laid so extremely roughly and carelessly, and with so little regard to keeping any even surface, that they seem to point to the use, or at least the intention to use, a coat of stucco to cover their nakedness. The fact that similar towers on the other side of the German Ocean, in Norway, Denmark and Germany, are nearly always stuccoed, lends some colour to the theory. Seeing the position of a large majority of the towers near the coast, the probability that the form was borrowed from one of those countries seems to come very close to a certainty, and although, when once introduced, its continued application possibly owed much to the fact that no freestone was required for quoins, it appears unnecessary to fall back upon the theory that some person was clever enough to invent the form on that account. The value of stone is remarkably accentuated in some of the earlier Suffolk churches, where only just sufficient is used to cut the door and window jambs and arches out of; sometimes, as in some windows at Debenham, leaving barely an inch in width beyond the moulding.

I do not think that flints were ever used otherwise than as rubble until towards the end of the Decorated period; but so few examples of earlier churches exist in the flint districts that there is only a little negative evidence to go upon. For a long time after this the use of guaged flint was very exceptional, and it may even be that the apparent exceptions are later insertions. In fact, I can find no evidence which would justify any positive assertion that the squared, or guaged description as it is called, was introduced before about 1450. The dates of most examples are not to be found, but the few that follow all bear out this theory.

St. Peter-Mancroft, Norwich, was finished in 1455; Southwold Church in 1460; Walberswick, near Southwold, was built between 1472 and 1493; Saxmundham Church was finished in 1483. The flint work in Wymondham Church, Norfolk, bears the date

[43] For a critical essay on the subject see *The Church Builder* for 1878-79, a paper on "The Round "Towers of Norfolk and Suffolk."—F. T. B.

1473. St. Mary-at-Quay, Ipswich, is said to have been restored *about* 1450, and the work there is rough. The date of the aisle and porch of Wetherden Church is given as 1483. Long Melford was only begun in 1450, and the Lady-chapel finished in 1497, while the florid work of Lavenham is known to be later still.[44] I at first thought that, before this time, bands of brick or tile or stone must have been commonly used to tie the facing to the wall, or at least to flush up the courses or form a longitudinal tie. It seemed difficult, for one thing, to understand how otherwise the flush-panel work of a later date was suggested, or came into existence; but it is very remarkable, if this was the case, that so few, if any, examples of it are to be found in the eastern counties. There is Cliffe Church, Kent, with alternate bands of flint and stone; but that is too far off to have had any influence. The porch of the Guildhall at Bury St. Edmunds is banded with double courses of brick, and a piece of parapet at Haughley Church has bands of single courses of brick. The nave walls of the little church at Wittlewood, near Wymondham, are of alternate courses of brick and flint. The north aisle of Ixworth Church, where the coat of stucco is broken, is seen to be regularly banded with double courses of tiles, and the tower of the little church at Gosbeck has a few bands of tiles in single courses; but these are about all the examples I know, and I believe they are all of the later period.[45]

At about the time of the conclusion of the Wars of the Roses a great North Sea trade seems to have been established on the east coast, and a consequent wave of prosperity swept over the counties of Norfolk and Suffolk and carried away most of the old churches, leaving, in their stead, some of the most magnificent ecclesiastical buildings in the land. The suddenly developed wealth would probably have enabled the builders to fetch stone from Barnack or elsewhere, and to have dispensed altogether with their intractable native flint; but they were fortunate, or enterprising, enough to discover a method of using the latter which enabled them to produce with it as rich effects as could possibly have been obtained from freestone.

How the flush-panel and diaper work of split flint and stone first came to be used is, surely, a greater mystery than the origin of the round towers; it seems to have sprung up suddenly at the period named, and once started the fashion spread like an epidemic; every one strove to outdo his neighbour of the next parish in the variety and extravagance of his designs; fancy, in many cases, ran perfectly wild and, though beautiful features and buildings were produced, the result was not satisfactory in all cases; originality and variety being evidently as much aimed at as elegance and refinement. The result was a perfectly bewildering mass of designs, which I will make an effort to reduce to some sort of order. In the first place, it is necessary to point out that there are two distinct systems—one, at the Thorpe Chapel [xlviii, 128] attached to the Church of St. Michael-in-Coslany,

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44 In the *Archæologia,* vol. iv, p. 106, in a paper written in 1774, Holbein's Gate in Whitehall is mentioned as having been erected *about* 1530, and as being ornamented with flint.—F. T. B.

45 In the *Archæologia,* vol. xii, p. 178, in a paper written in 1795, it is said that "The Romans used "flint in wall masses and afterwards faced the work with alternate courses of squared flint and stone," but that "this, however, became afterwards neglected." Burgh Castle is referred to as an example.—F. T. B.

Norwich, and the churches at Lavenham and Long Melford [xlvii, 127], in which the dark flint is used as the ground to show up tracery of freestone; and the other—at the large majority of Suffolk churches, in which a stone wall is divided into panels filled up with flint. The former can never I think be pleasant to an architect's eye, chiefly because it is—and even without a thought our instinct tells us it must be—false construction, the small material, which we know to be but a facing, showing as the body of the wall while the decorative lines alone are of solid stone. For the latter I claim that it may be—would that it always were—perfectly true as well as beautiful.

In this panelled work we find panels of all kinds and sizes, upright panels with cusped heads, with foliated heads, with crocketed heads, with heads both cusped and crocketed; circular panels and square panels, themselves trefoiled, quatrefoiled and multifoiled, with round foils and pointed foils, containing shields and monograms, and single initials, and intricate interlacing knots, and complicated imitations of tracery, crowns and crosses, anchors of hope and stars of promise, flagons and sacramental plate, and numerous devices to which no general name can be given. Then there are running patterns, some in imitation of the crestings of the wooden screens, themselves so beautiful a feature of the East Anglian churches; there are diapers covering vast wall surfaces of all imaginable designs, of which the commonest is a plain chequer pattern, in which the white squares are Barnack or other freestone, and the black squares flint; this diaper is used in some part of at least one building out of every three in which squared flintwork occurs. Good instances are: the south porch and west side of the Tower, Southwold Church, the plinth of the south porch of Stowmarket Church, the parapet of the porch of the Guildhall at Bury, the north aisle, Mildenhall, and the plinth of the Tower of Combs Church near Stowmarket. The same diaper set diagonally, which is almost as common, may be seen in the end of the Guildhall at Norwich among other instances. In the east end of this same building is also a diaper of triangles which has a little the effect of scales.

The running patterns in bands are not less general, and are even more varied in design, than the diapers; a common one consists of a waved stem with, or occasionally without, sprays, carrying square, circular or trefoil knobs, evidently borrowed from the ordinary foliage decoration in the hollow mouldings of the period; or the stem is foliated on either side as in the enriched strings. Then there are the bands consisting of various traceried patterns, such as trefoils reversed and fitting into one another, or quatrefoils with the angles filled, or a lattice pattern without and, again sometimes with, foliations [xlix, 150], round, pointed or straight-sided, or containing shields or devices; then, I suppose, the texts and mottoes so frequently found may, in a sense, be called running patterns, at least they answer the same æsthetic purpose and occur in the same situations; and the cresting pattern before mentioned, which is seen in the Thorpe Chapel, must not be forgotten. Bands of flint decoration are, however, most frequently formed of detached panels or devices, and sometimes these are mixed with moulded freestone panels not containing flint, as in the plinth at Wetherden [xlix, 144, 145].

Upright panels occur with trefoiled or cinquefoiled heads; sometimes with the spandrils either of the heads or cusps, or both, filled with flint; sometimes with them left

solid or filled with a shield, as in the plinth of Cromer Church [Illustn. xlix, 142]; or cusped as in the porches of Halesworth [xliii, 118], North Walsham, Worsted, and other churches; in parapets, clerestories and other features, in more instances than it is possible to mention. Very frequently the head is a four-centred curve under which, and some way lower down, is a second cusped head and crocketed canopy, more or less neatly cut, and generally with a slight curve; such a design gives a richness hardly surpassed by the most expensive carving and moulding, and a vigour and sharpness of outline which nothing of the sort could hope to equal. It is again so universal that it is superfluous to multiply instances, but I may mention the tower of Southwold Church, the porch of Troston, the buttresses at Blythborough; clerestory Saxmundham [xli, 112]; clerestory Framlingham [xl,110]; clerestory Coddenham [xl, 109]; clerestory Earl Stonham [xl,111]; plinth Wetherden [xlix, 144, 145]; clerestory Woolpit [xli, 114]. The canopied head also occurs frequently in the tracery system without the upper arch, as in the Lady-chapel at Long Melford and the clerestory of St. Clement, Ipswich [xli, 113], and other instances. It is impossible to adequately describe the charming forms taken by the crockets and finials, which are in most instances of vigorous and sketchy outline, as might indeed be expected; in a few cases, as in the clerestory at Saxmundham [xli, 112], there is an attempt at the flowing lines generally adopted after a while when the skilful artist translates solid into surface decoration. The panels frequently take the forms of Perpendicular tracery by the vertical division of the heads, and indeed nothing was done at the period in either wood or stone which was not imitated in this flint panelling.

The square and circular panels which fill the battlements, and stand in rows in the plinths, are of so many designs that they defy any general description. Filling the quatrefoils and circles are usually shields or devices, among the commonest of which are the sacred monograms, the initial M., or the monograms or initials of founders or patrons; or the filling is some tracery pattern, as often as not the one which somewhat resembles three tadpoles chasing one another in a circle.

There is no part of the exterior of a church to which this flush panelling is not in one example or another applied, but the features most frequently decorated with it are the clerestories, porches, parapets, plinths and buttresses, and I next propose to call your attention to some few of these of which I have been able to collect illustrations.

Among all the beautiful features of our late churches, especially in the eastern counties, one of the most beautiful, and not the least characteristic, is the light open clerestory, by which the greater amount of light is admitted far above the level of the eye; in a similar way to that in which it shines into the Renaissance churches of Italy, producing there such quiet reposeful effects, so conducive to devotion and meditation. In this country that effect is marred, or, in fact, lost by the addition of horizontal light in the shape of aisle windows, often, perhaps, necessary in our darker climate, but disturbing both to the eye and the mind. But, while noting this, I would prefer to dwell upon the beauties of the clerestories themselves, beauties which we might look for in vain out of our own dear country. In all the examples I have sketched the feature is divided into two heights by the hood-mould returned

as a string at about the level of the bottom of the tracery. In all but a few the spaces above and below this string are both filled with flush panelling—the simplest and quietest example I have, is, I think, that of Earl Stonham near Needham Market [Illustn. xl, 111], but, from some correspondence I have had with the rector of that place, I cannot be certain; the spaces between the windows are divided, both above and below, into four narrow panels, rather more than half as wide again as the stone muntin separating them, and having trefoiled heads, to which, in the lower division, are added crocketed canopies under a second arch; the spandrils over the window-heads are also filled with simple panels.

The clerestory of Coddenham Church [xl, 109], in the same neighbourhood, is much more elaborate and thoughtful; one of the four panels is omitted, to give more width to the window jambs, and the panels immediately surrounding the window-heads are arranged so as to emphasize and give greater importance to them. This clerestory is still surmounted, as the others probably once were, by a flint and stone battlemented parapet of very elaborate workmanship, every panel of which is varied in design. Next I would mention the clerestory of Saxmundham Church [Illustn. xli, 112], which has, I think, the most refined and artistic detail of any. The outlines of the crockets in this panelling are, as I said before, usually a rough sketch of the solid crockets of the period, but here they are a thoughtful translation of them, and not only are they and the cusps exceptionally carefully drawn, but the designer has not been satisfied merely to copy, at any rate as regards the finials, but has designed finials of his own, with long flowing lines filling up the square-headed spaces and with the happiest result. Under the cornice of this church has once been a frieze of fifteenth-century letters, I think on a flint ground, forming a text or motto, but only a scrap is now left, and that has evidently been displaced in the course of some restoration and is, to me at least, undecipherable. The clerestory of St. Clement's Church, Ipswich [xli, 113], is, like most of the flintwork in that town, large and coarse in outline and, instead of being designed with the windows, forms a continuous arcade into which they cut at regular intervals in an unpleasant way. The string is strengthened in effect by a band of quatrefoils over it. This band is, in the elaborate clerestory at Woolpit [xli, 114], developed into an important feature filling the height, from the string to the level of the springing of the arch, with a large chequer; this Woolpit clerestory is the most important in the sense of size and variety of design that I have come across, but the result seems to display more of fussy ambition than of good taste. The Framlingham example [xl, 110] differs from all of these in several important points, in some of which it is delightfully original and, so far as I know, unique; firstly, the windows are large three-light ones to make up for their being only one in each bay; then the space above the string is plain, and the panelling confined in a very pretty way to the centre of the lower division, leaving a strongly marked pier on each side of the window, which well expresses the position of the trusses inside. The fine church at Walsham-le-Willows has a clerestory with some noticeable features [xlii, 115, 116]; on the south side there are, at each end, a couple of windows with semicircular arches, the flint tracery is throughout confined below the string and, except at the ends, consists merely

of one square panel, so that a strongly marked horizontal band ties the windows together; the relieving arches have voussoirs of flint and bright red brick, and the springing of the arches is marked by a band of stone; the effect altogether is pleasing, and the more so from being due to such simple elements. The clerestories of Bacton [Illustn. xlii, 117] and Cotton churches have much the same character, with the addition of another square panel filling the space above the string to the springing of the arch, and a vertical stone rib between each window. These are a few typical examples of the flint panelled clerestory which is so prominent a characteristic of the typical Suffolk church—an architectural feature, of the grace and light consistent beauty of which English architecture may surely be proud.

After the clerestories, the porches are the most important features upon which the flintwork was lavished. Two, of which I am able to show drawings, seem to me to be, though small, as charming pieces of design, in their exquisite proportions and simple grace, as are to be found anywhere. I refer to those of Halesworth and Blythford Churches [Illustns. xliii, xliv]. Blythford is a little village close to Halesworth, and the one porch is evidently a humble imitation of the other. I would call attention to the breadth of the whole design, due to the low pitch of the gables, the strongly marked horizontal bands, and the broad wall spaces on either side of the openings. The parapets are of panelled freestone, without flint, which is surely but reasonable, for gauged flint is only a facing material, and a parapet nine inches thick hardly needs to be built of one material and faced with another. If the flint were used, it could only be cut into the stone in order that the parapet might be like the wall; the strong horizontal band above the arch and at the base of the gable is remarkably valuable as tye-ing the design together at that point, and giving the triangle a sort of firm base to rest upon; the band, too, marking the springing of the arch, seems to be very much in its right place. The series of panels in the gable, rising in height towards the centre and leading up to the niche, remind one of certain Italian buildings, and I would call attention to the fact that, though all the lines are vertical, the general effect of them, owing to the repetition, is horizontal; to this fact I attribute much of the repose of the design. Some of the most elaborate flint panelled porches are the very late ones of Southwold and Mendlesham Churches [Illustn. xlv]. The south porch of the latter is in one storey only, whereas the other and the Southwold porch are each in two, and the parapet of the latter has no flint in front; otherwise all three are almost exactly alike. The horizontal band above the arch occurs again, as in almost all doorways of the period, but the band at the springing is absent. The most remarkable feature is the narrowness of the flint panels at the sides of the arch, and the way horizontal lines are avoided in that position by raising the transoms of the centre panels. You will notice the peculiar form of the transoms, if I may call them so, which are not horizontal on the top, as in earlier instances, but run up into a sort of finial. The sides of the Southwold porch are covered with flint and stone chequer work in about 5-inch squares.

There is a good flint panelled porch to the remarkable church at Cotton, of which unfortunately I have no illustration. The church is situated near the railway station

of Finningham, and is well worth a visit by anyone who happens to be in the neighbourhood. In the tower, instead of the window and door in its west face, there is a great arch, and the window and door are relegated to the inner wall. The building has also one or two other uncommon features, but notwithstanding a perfect network of iron ties, seems to be imminently threatened with collapse. To return to my subject: I have had my sketch of the porch of Ixworth Church enlarged [Illustn. xlvi], as much as anything to show that the use of this flush-panel work is not sufficient in itself to produce a good effect. This porch, it seems to me, is of a very commonplace order, and without evidence of much thought in its design. The panels are all alike, except that an extra wide one is treated to a cinquefoiled instead of a trefoiled head, and the panels seem to be tumbled into any space that will hold them, whether they fit or not.

From the porch to the gate is but a few steps, and this therefore seems the place to mention certain abbey gateways. St. Ethelbert's Gate, to the Cathedral Close at Norwich, has a flint panelled gable on either side; and the St. John's Gate, Colchester, and—as I am informed—St. Osyth's Priory Gate at Brightlingsea, are specimens of the work. The patterns on the inside of St. Ethelbert's Gate are rather large and coarse, while on the outside the lines of the stonework look, on the contrary, very thin and meagre. This latter gable is, I am told, a restoration on exactly the old lines.

The West Side of the tower of the large and fine church at Southwold, so well known for its roofs and screens, is a remarkable specimen of flint work. The great window and the door beneath are, as is frequently the case in the late churches of Norfolk and Suffolk, so treated as to form one feature; they are only divided by the stone sunk band of shields and cresting which runs across immediately over the door, like the bands in the porches. On either side of the window is an elaborate and beautiful niche, from which our Puritan ancestors have of course dragged the "graven "images." Over the arch of the window, in white stone letters on a flint ground, are the words "SAT EDMUND ORA P NOBIS;" and all the rest of the surface is occupied by flush panels, up to a deep band of chequer work which occurs under the little window of the ringing stage. In the panels on either side of the door are some odd little pedestals, which are pretty, though I suppose very childish and irrational, seeing that they can be of no possible use to put statues on.

Though the clerestories and porches of the churches afford the finest fields for the display of the flush panelling, the plinths and parapets, especially of the towers, as well as the faces of the buttresses, seem to have been most frequently ornamented with it. The elaboration of the parapets in particular, and they are *most* elaborate, shows true artistic feeling; to reserve for the summit of the whole work his richest effects, to crown it with his brightest jewels of design, has been the habit of the true architect in all ages. The sculptured pediments of Greek temples, the crocketed finials of Gothic cathedrals, the beautiful belfry stages of towers and campanili, the arcades that crown the walls of Romanesque churches and the cornices of Renaissance palaces, all show the same feeling. The finest parapets I have sketched are those of the towers of Woodbridge and Walberswick [Illustn. xlvii, 123, 124]. Of the former of these it is not too much to say that

it is a perfect architectural gem ; delicate in detail, graceful in outline, and thoughtful in design. The introduction of a moulded sunk panel, at intervals, in the flint tracery is a rather common device, and each species of ornament gains, by contrast, with the other. The strong band below the parapet, tye-ing, as it were, the work together, is a marked feature in many of the best towers of the period. It is charming, too, to see how the ornament is fitted to its place ; square panels in square spaces, and upright ones in upright spaces. The tower of poor Walberswick Church has a somewhat coarser but hardly less beautiful finish. The lower band is double, one line being sunk and moulded, and the other formed of a series of flush panels, of which every other one consists of four lozenges of flint. The battlemented parapet is doubly stepped, and all the panels are upright except the lowest, which consists of the usual shield in a cusped square, and a bit of *un*usual ornament of stone flowers set in a flint ground. The flint ornaments of this church are, many of them, different to what one usually finds, and mostly of very simple patterns [xlviii, 137-140].[46] The brick and flint parapet at Haughley [xlviii, 131], which I mentioned before is only remarkable because it is unique. Those of Coddenham and Heigham [xlviii, 130, 133] are good typical examples of the simplest work. The Halesworth and Blythford [xlviii, 129, 132] examples are also typical of other much used designs; the latter is a simplified variety of that at Walberswick. It is unnecessary to describe them all in detail, their peculiarities will be better appreciated by a short glance at the drawings than by any reasonable number of words; but I would point out that the proportion of the panels is in all cases thoughtfully cared for. The Blythford parapet is a particularly good instance; the highest portion has but one panel, but in the next division are two, because *one* would look stunted, and in the lower part, where even *that* expedient would be insufficient, a new treatment rather than a new proportion is introduced. The parapet of the tower of Ixworth Church [xlvii, 125] shows a similar arrangement. The nave parapet of Coddenham Church [xl, 109] deserves attention for its elaboration and peculiarities, to wit, the introduction of the sacred monograms and bits of running ornament, a treatment totally different to that of the tower parapets just mentioned, which are calculated to be seen at a great height. The pretty little parapet of the south aisle of the church at Fornham All Saints, close to Bury St. Edmunds [xlvii, 126], is remarkable for its simplicity, regularity and pleasant proportions; the circles contain letters and devices.

Coming next to plinths, there is little in them to describe. In the upright face between the upper projecting moulding and the second set-off, which is an invariable feature of fifteenth-century churches, is generally a plain row of simple upright panels with foliated heads [xlix, 141-143]; or of square cusped panels containing shields, on which there are seldom any coats of arms; these often alternate with others enclosing letters, monograms or other devices, and sometimes the square panels are alternated with one, two or three upright panels; in other instances moulded panels are introduced, but a certain regularity and continuity is observed and the whole treated rather as a band.

The outer face of the buttresses is always one of the first places to be ornamented with split flint, and even in churches where all the rest of the work is perfectly rough, it

[46] Compare with 134-136 [xlviii], and also with 151-165 [xlix].—F. T. B.

is often found to be very neatly executed, and formed into a species of panels by the introduction of upright stones half way between the short quoins; these stones sometimes, as in the porch buttresses of Coddenham Church [xlix, 154], just catch the edges of the long quoins, and so the stonework is made into a self-supporting skeleton in which the flint facing is framed. This arrangement is, in more elaborate examples, developed into long narrow panels, often running up the whole height of each stage and ending in simple cusped or crocketed heads. The buttresses of the porch of Cockfield Church [xlix, 146, 155], near Bury St. Edmunds, have simple crosses in the face, formed by letting the long quoins meet, and introducing some of intermediate length between them and the short quoins; the largest of these crosses are filled with white lozenges of stone. Another common method of ornamenting buttresses was to build them of freestone and introduce devices in flint at intervals, the tower buttresses of Ixworth Church being an instance. The buttresses of the tower of Halesworth Church are rather remarkable [xlix, 156]: the faces batter on all sides (as is not unfrequently the case with the buttresses of large late towers, only in this instance it is very decided and consequently immediately noticeable), but the chief peculiarity is that the heads of the panels, with which the front faces are ornamented, are cut in large stones laid on their beds which tail a long way back, while the upright sides are of mere strips set on end, and, the divisions of the panels being numerous, the effect on the side exactly resembles that of the so-called long and short masonry, which is the most certain characteristic of Saxon work.

The stone quoins in late flint work are generally very regular in size, internal ones are sometimes ordinary square stones, which consequently show only on one face, but more frequently they are sunk out with a short return, and show long and short on each face, like external quoins [xlix, 147, 148]; it is very usual to replace internal quoins altogether with a strip of stone sunk out to an angle [149]. Very occasionally indeed quoins are worked in large flints, and in two instances in domestic work I have seen them in brick, namely in a house, now all but ruinous, close to Brandon Church, and in a part of the Dolphin Inn at Norwich.

There are a few examples of relieving arches constructed wholly of large flints: those of the windows of St. John-de-Sepulchre at Norwich, for instance, but more frequently they have alternate voussoirs of brick and flint, as in those of the clerestory windows at Walsham-le-Willows and Bacton [xlii], or the tower openings in Mildenhall Church, and the belfry windows of Woodbridge Church [xlvii, 123]; in both of which last, the voussoirs are of two bricks each. Still more generally they are of *stone* and flint similarly treated; in either case it has not been considered necessary to cut the flint voussoirs out of single stones, as they are generally in two and sometimes in three pieces.

This seems the place to speak of a matter that is a little puzzling, namely, that the flint facing of towers is seldom, I believe I might say *never*, similar for its whole height. Even in the roughest random facing there are sudden changes at various heights, either in the size or colour of the stones, which I at first attributed to the material being collected from various localities (one load arriving one day, for instance, from the South, and another, another day, from the North); and I thought that, instead of mixing the stones, one lot

was used up first and then another; but when I came to examine the towers of Lavenham, and other important churches, and found the lower stage very carefully executed with perfectly black material, a few discoloured flints and pieces of freestone introduced in the next stage, and more and more of these in each successive one, the only alternative to confessing the result intentional was the unworthy, and unlikely, one of supposing the builders to have gradually wearied of their extreme care. The reason may be conjectured to have been either that it was erroneously supposed that distance from the eye would hide the defects, or that gradually modifying the blackness of the facing would give, as it certainly does, increasing lightness of appearance to the upper stages. I will venture to hazard an assertion that the latter is the true explanation.

It would be impossible to leave the subject of flush flint tracery without a special reference to the churches of Lavenham and Long Melford [xlvii, 127], two of the finest specimens of late Perpendicular work and two of the grandest churches in the country. I hardly know how, but there seems an idea prevalent that they are first-rate, if not typical, examples of Suffolk flintwork, and against such an impression I must enter a strong protest, for, in my opinion, it is likely to give the work a bad name among men of artistic culture. These buildings owe little, if anything, to their flint tracery; in some ways they suffer from its use. In the first place it was little short of barbarous to break up the small wall space which the clerestory windows and their mouldings left as rest for the eye; then the patterns themselves are clumsy and do not fit their positions; and lastly—not to speak of the reasons already assigned for objecting to the system here adopted—the tracery has the appearance of having been spread over the wall before the windows were thought of, and of having been then cut away to make room for them. The flintwork of the Lady-chapel at Long Melford, is an improvement on that of the body of the church, but has too many of its faults, and among them that of being laid without discrimination over the whole wall surface, producing the effect of a sort of skeleton building. This remark applies with equal force to the celebrated Thorpe Chapel [xlviii, 128], attached to the Church of St. Michael-in-Coslany, at Norwich; and in my own mind I cannot help condemning such an extravagant outlay of rich effect as vulgar, though the details of the Thorpe Chapel are exquisitely delicate, and executed with remarkable precision.

It only remains to say a word or two about the rare instances in which guaged flint is used in sunk and moulded panels before considering the practical questions of the present and future application of the material. The only examples of this sort of work that have come under my own notice are the nave buttresses of Cromer Church, those of St. Margaret's, Lowestoft (a building that deserves to be better known to students than it is), the buttresses of the south porch of Southwold Church, and part of the clerestory of Wymondham Church. I believe that many other instances exist, but comparatively they are rare, probably owing to the double expense involved in dressing the flint and in moulding the freestone as well. At Cromer the mouldings are deep and even undercut, and the traceried heads of the panels stand quite clear of the flint, which, it is also easy to see, has been built up behind the stonework after the latter was set; all

the flintwork, by the way, of Cromer Church, is splendidly cut and fitted, the edges of the stones are as straight almost as the edge of a T-square, and they are laid in the most perfectly even courses, all nicely breaking joint as if the strength of the walls depended on them; if neat facing could save a building there would not be half the church lying in ruins as there is at present.

Turning to dry practical questions; Brandon, in the north-west of Suffolk, was for many years the headquarters of the gun-flint manufacture, which still lingers there. Naturally some of the best guaged flint for buildings is to be obtained at that place, and thither I therefore went to see what I could learn of the quarrying and cutting of flint, as at present practised. How it was accomplished in mediæval times one cannot of course say, but probably by not dissimilar means. The present quarries, or pits, as they are called—and indeed they are more properly mines—are situated on a sandy heath to the south-east of the town, about a mile to the south of the well-known Grimes Graves. Each pit is worked by one man only, and is merely a shaft of 40 feet or 50 feet deep, stepped in falls of about 6 feet, for the convenience of lifting the material, and a gallery or galleries at the bottom, at the level of the best bed. On the surface is a stratum of sand from 7 feet to 10 feet deep; then come 12 feet or 14 feet of loamy chalk, or dead lime, scattered through which are large numbers of small flints, at the largest a little bigger than a man's fist, irregular in colour when split, and full of hard lumps; this is called the "horn" bed; the stones are generally used whole for the roughest walling. Below is the chalk in which, at intervals of 7 feet to 11 feet, are beds of large flints, or in some places a little pipe-clay. These beds are never more than one stone thick—that is, from 8 to as much as 18 inches; but the stones measure 2 or 3 feet across, and the largest must weigh a hundredweight or more. Such stones, however, are never got whole, the pieces taken out seldom being of more than half the size. The tools used in the pits are a one-armed pick, a small crowbar, and a heavy clumsy-looking hammer.

There are, exclusive of the "horn," four beds of flints. The stones in the first, or top, are very irregular in shape and hardness, and the upper surface is covered with lumps, or as they are termed "paps," from which the under side is free. The majority are grey in colour and very hard to work, and are considered inferior; but when they are good they are very good—the best of all, in fact—of a jet black, which does not change by exposure (a questionable advantage to my mind, but considered in the trade very important), and exceedingly hard and durable. Then there is the "wall" bed, always of a good black colour, but uneven in texture, liable to fly to pieces when struck, instead of splitting, and often with blueish grey rings and spots (which is called being "jackdawy"). The third bed is called the "upper crust"—not a complimentary name, for the bed is also considered an inferior one. Finally, there is the lowest bed, or "floor stone," which is the one most in demand; it is comparatively regular in shape, smooth on both sides, even in texture, softer, if one can apply such a term to flint, and easy consequently to work, and of a pretty grey colour; its only defect is that this colour, in many specimens, is liable to fade to white. The floor stones, as well as the best of the others, are cut into gun

flints and guaged flints for the best facing work ; the inferior qualities become random flints for inferior facings ; the larger waste, of which enormous heaps accumulate, is used for rough walling, and the chips for concrete.

For guiding me to the pits, and for much of the above information, I am indebted to Mr. R. J. Snare, of Thetford Road, Brandon, who also afforded me the opportunity of seeing the stones worked, and supplied me with a set of tools. They consist of four kinds of hammers, and a so-called *stake* or anvil ; they are all made of steel except the heavier hammers, which are of iron faced with steel. The flaking hammer is of a double conical shape with neat square ends, and is the most used; the English hammer is generally an old flaking hammer ; and the napping hammer is made from one of the large files used for forming and trimming the edges of the tools, and is a rather curious looking weapon.

The principle on which the cutting is done consists essentially in *chipping* a smaller piece off a larger one ; to attempt to *split* a stone results in *smashing* it into pieces of irregular shape. The first process is to knock off a " quarter," or core, as it is called ; a lump, in fact, of workable size—say 8 inches to 12 inches across, and 4 inches thick, from the large stone. This is done by a workman seated on a low stool, who lays the stone on a leather pad strapped to his left knee, and after a few familiar taps, a sort of taking aim, strikes the piece of stone he desires to break off, sharply, with a quartering hammer of a size suited to that of the piece ; the hand is kept low, and the blow delivered nearly in the direction the fracture is desired to take, but a little inclined to the small part to be broken off. If the stone is a good one, the fractured surface is smooth and even ; next the white " coat " is broken off, and any other necessary rough trimming done with the " English " hammer ; this coat, when not removed, turns the mortar joints yellow. Then, if the stone is to be random dressed, some few flakes, which are afterwards made into gun flints, are knocked off to get it into shape, and it is trimmed up with a dozen or so taps from the " napping " hammer ; if, on the other hand, a guaged flint is required, the outline is drawn on the surface with a template, the stone carefully and gradually trimmed down by knocking off flakes with the flaking tool, and finally finished on the stake, or sometimes by a skilful hand on the knee, with the napping tool, the result being a wonderfully sharp and even edge to the face of the stone. The preliminary taps and the hammer strokes are given in the same way in every case ; the outer edge only of the hammer point touches the stone, and immediately slips off, and the fracture takes place at the point of contact. Both random and guaged flints are finished with two different surfaces—the one smooth as it comes from the quartering tool, and the other " back " chipped " to a fairly even face ; the latter takes more time, and is subject to the risk of being spoilt in the last blow or two to the surface. The former occasions the waste of a vast amount of material before a sufficiently level bit of surface can be found.[47] The price for either, as given me by Mr. Snare, is about 6s. per bushel for square flints of no particular size ; for irregular shapes, or all of one size, considerably more ; for random

[47] The face of the stone exhibited was only 2 inches by 2⅝ inches, and was cut out of a piece having a superficial area of nearly a foot.—F. T. B.

dressed flints 2s. 6d. per bushel; and for waste, for rough walling, about 4s. 6d. a ton of twenty bushels: all these prices being nett, delivered on the railway.

In old work, even in the earlier facings, I have never found any in which the stones average more than about an inch-and-a-half in depth, and the later the work the shallower is the facing, especially where the stone is merely sunk out to receive it. When I first discovered the shallowness of the facings, and that the stones were only square on face and conical behind, I experienced a shock such as comes to people when they find out that that fine dog, they have given such a sum of money for, has fits! Not only is the facing of flint thin, but as a rule the stone framework where it is used is not much thicker, which is a much more reprehensible sham; for the idea conveyed by the appearances of the panelled work is that the use of the stone is to tie the facing to the body of the wall; the horizontal bands are, in the earlier work, and sometimes in the later, so used, I think, perhaps oftener, than there is any direct evidence of, for how otherwise does the facing cling so long to the wall? But in the latest and most elaborate examples their original use is often forgotten. The cusped heads of panels and the openings of other patterns in the flush work are occasionally pierced through, a circumstance which I have usually accepted as evidence of early work, but there are so few chances of testing the fact, owing to the good state of preservation of most of the examples, that I cannot speak certainly on the point, and it often is due only to the panel being a large one, and the frame constructed in several stones, when it becomes probably the cheaper course to adopt; but in the majority of instances the cusped panel heads, the quatrefoils, and other patterns, are merely formed by sinking out the stone in the shape required, and filling the sinking with the flint. These sinkings, where the flint has disappeared, are found to be incredibly shallow, often not half-an-inch deep in the centre, and running off to nothing at the edges, so that if the work is as far from the eye as, for instance, an aisle parapet, and the flint has fallen, the pattern is quite undecipherable. We may well imagine that it is just in the extreme cases, where the work was shallowest, that it has decayed in this way; but that at best it was not much deeper, at any rate in the later examples, I am satisfied after examining a large number.

Building in flint has to be done carefully, and certain precautions must be taken. Owing to the irregular shape of the stones a large quantity of mortar is used, which in consequence of their non-absorbent nature takes a very long time to set; consequently if the work be hurried, and weight added too fast, the lower parts of the wall are certain to bulge, and if wrought stonework, with its comparatively fine joints, is introduced, the flint-work is extremely likely to settle away from it while green; in consequence also, of the smallness and roundness of the stones the bond, unless other materials are introduced, is very bad. Some caution and practice are needed to successfully overcome these and other difficulties and peculiarities, and I will, as rapidly as may be, run through some particulars as to the practical use of flint in building, and the precautions necessary to be taken. I am indebted to various sources for my information, among which I have gratefully to acknowledge letters from Mr. Hubbard of East Dereham, Mr. Goss of Thetford, and especially Mr. Gammon of Petersfield in Hampshire, all practical builders accustomed to such work.

First, as to the material for rough rubble walling, which is done with the small stones found in the surface stratum: all agree that the chalk flints are better than those from other soils in respect to soundness and colour, and of these, the flints picked from the surface, which have stood the test of exposure, are supposed to be more reliable than those dug on purpose, which may prove brittle or change colour. Then, some practice is required by the layer in picking up the right stone to fit the position he wants to fill, or in choosing a position to fit the stone, for it is essential to the solidity of the wall that flints should fit as closely as possible; and a practised man will seldom lay one down again, but will manage to find it a place somewhere. Care should be taken to lay each stone with its broadest surface outwards in order to get a close joint, and it is still more desirable that the top bed should be nearly level, or tending downwards and outwards, to conduct rain-water away from the inside of the wall. To avoid shaking the work already executed, the stones should never be hit with a trowel but pressed into their places by the hand. The mortar must be stiff, and of quick-setting lime, with an equal quantity of sand, and well beaten up. It is very desirable to carefully flush up the work at each course, but no grouting should on any account be allowed. The joints must be struck full, either of a V-shape, or semi-circular, in section, especially where the stones are very round, for if this is not done the joint has a feather edge; long bonding flints should be built in at frequent intervals, say three to every yard. Owing to the poor bond and uneven bed of the material, flint rubble walls should in no case be less than two feet thick; plenty of time should be given for execution; above all, the work must be protected from the wet, and be altogether abandoned and carefully covered up during rain. Thus executed, flint rubble is said to make exceptionally strong and durable building, but any failure is quickly followed by complete ruin. To assist in indurating the mortar, broken bricks and tiles are often built into the interior of the wall, and sometimes for the same purpose dry ground lime is shaken over the work, but this must be done with great caution, as a very small lump will blow and cause a bad split. Long bonders of freestone have from the earliest times been very commonly used, as well as lacing courses of tiles or brick, which are most useful, both as bond and to flush up the work; they do not always appear on the surface. In modern work, which has to be executed quickly, it is customary to use a great deal of brick in quoins, piers and lacing courses, and if this be done the work is said to take but very little more time than when it is all of brick. Flues must of course be in brickwork or piping. In facing with random dressed or guaged flints, Portland cement should almost always be employed, the small extra cost as compared with that of the material, especially in guaged work, being unworthy of consideration. To get an even black surface without the trouble of galletting, or possibly in addition, black dust is sometimes shaken over the work while it is wet, and afterwards brushed off again. Stone strings should be dressed full to the square on the top, so as not to carry water inwards; and it has been recommended that all *upright* stonework should be built *after the flint has taken its bearings,* bond stones always being left projecting in the first instance.

A yard super., 2 feet thick, of rubble walling takes about 5 bushels of rough flints and 16 bushels of lime and sand mixed dry. Two wallers and two labourers will do

about 5 yards a day. A yard super. of facing takes about a bushel of random flints, or $1\frac{1}{2}$ bushels of guaged flints and about the same quantity of lime, and a waller and labourer will do about $5\frac{1}{2}$ to 6 yards of such work in a day. In the *Dictionary* of the Architectural Publication Society is a comprehensive list of prices ranging from about 6s. per yard super., 2 feet thick, for rough walling, all materials and labour included, up to 15s. 9d. extra per yard super. for the best guaged facings; and since the writing of that article the cost does not seem to have altered as much as might have been expected; the prices quoted to me are from 6s. 6d. to 7s. 6d. for rough walling, from 2s. to 5s. 6d. extra for facing in random flints, according to the quality of material and excellence of preparation, and from 4s. 6d. to 12s. 6d. extra for guaged work of all square stones, and up to 32s. extra for the finest tracery and panel work. I confess these prices to be vague; but the amount of labour it is possible to bestow upon the work, and even the quality of the material varies so much, that without providing a detailed specification of each description it would probably be difficult to get anything much more definite.

In conclusion, I would express a hope that it is unnecessary to argue in favour of the occasional adoption in these days of cut flint facing, when an opportunity occurs, if only for the sake of a little variety; it is sufficient to point out that if plenty of long bonders, either of the flint itself or of stone, be used the work will be perfectly sound; and also that if it once be granted that facing at all is permissible, then, for concrete walls, what facing could be better than random dressed flint? The material would be the same, or very similar, only of a better kind to that of the body of the wall, and the large quantity of mortar used would cause it to settle almost equally.

In regard to the flush panelling, a great deal of which need not necessarily be executed in guaged work, the list of prices I have collected shows that the cost might not be prohibitive; and, from the point of view which I have attempted to show to be the right one, in which surface architecture appears as, not only no sham, but the most sensible and artistic, then its own intrinsic beauty is the only recommendation for its revival that it needs. And apart from mere revival, which is in truth but a backward step, it is surely capable of development, or at least of affording a few suggestions for those of us who desire to carry our art onwards. The most obvious of these is the substitution of other materials for the flint. Not to speak of guaged brickwork, which treated in that way would, one can imagine, be at least as beautiful, there are all the varieties of marbles at command, at prices high certainly, but not in these days of cheap carriage altogether prohibitive; and in what way could marble be more appropriately applied to buildings than in slabs cut to a form which does not suggest joinery, or any other material, and tied into the body of the wall by the stone frame which surrounds it? Of course we should not be guilty of imitating the fifteenth century to the extent of making *that, too,* merely, superficial. Then why should we not use, in a similar way, decorative panels of faïence or majolica, of simple design, appropriate to external decoration, like those by Della Robbia? Is it quite impossible to sink the panels slightly and decorate them with frescoes? I will even dare to suggest that a modern building decorated with

well designed tracery of the kind, executed in white marble delicately moulded, and the ground filled with mosaics, would rival in richness, and might easily be made to surpass in beauty, the gorgeous fronts of Siena and Orvieto Cathedrals. Or a less extravagant proceeding would be to use or develop such banded work as that at Clyffe; the bands might be of a variety of materials, stone and flint, brick and flint, brick and terra-cotta, brick and faïence, &c.; and anyone who knows the beautiful effects of this banded work in various Italian buildings will confess that it is worth more than a mere trial.

Probably some are thinking that these are impracticable suggestions, and there would be, of course, two difficulties in carrying them into practice, one to get even so short a distance out of our old grooves, and the other to find a public who would appreciate, or pay for, our efforts to give them something worthy of the great and wealthy and go-ahead nineteenth century; but surely difficulties should act but as spurs to our efforts. I ask, at least, that the matter may receive consideration at the hands of architects.

This interesting feature of our beautiful and thoroughly national Perpendicular style surely illustrates, in an emphatic manner, one of the best of our national characteristics, in showing how the very material which seems least adapted for ornament; which cannot be moulded; the very idea of carving which seems like a madman's dream; which, indeed, is well nigh useless for all ordinary building purposes; has, by the enterprize of our ancestors irresistibly overcoming its obstinacy, been made to supply the chief decoration of some of those beautiful temples of the Creator which adorn our towns, and stand as monuments of the piety and faith of our forefathers among the hills and hedgerows of our native land.

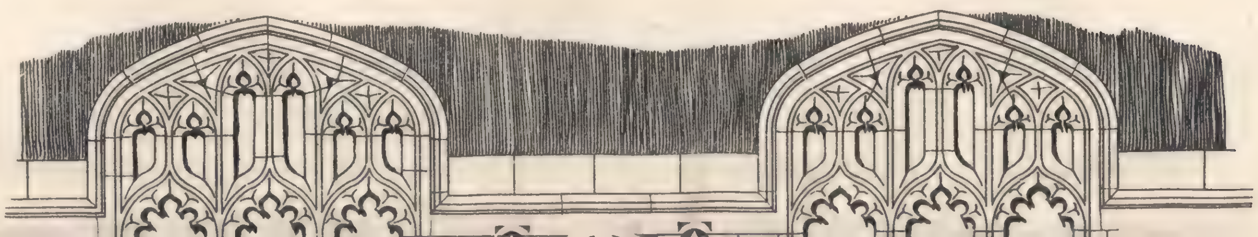
FRANK T. BAGGALLAY.

⁂ Wyatt Papworth, *Fellow*, calls attention to a footnote, at page 57 of the late Mr. E. de la Quérière's *Essai sur les Girouettes, Épis, Crêtes et autres décorations des anciens combles et pignons* (Paris, 8vo. 1846), in which reference is made to a house of the end of the fifteenth century at Verneuil (France), the walls of which are in "alternate chequers of stone and brick, and of stone and cut black flint."

⁂ Lacy W. Ridge, *Fellow*, referring to the use of flint in Sussex churches, writes:—The chalk and flint district of Sussex includes the South Downs, which enter the county near its north-west corner, and terminate in the sea near Eastbourne, together with the plain between the hills and the sea. At the very foot of the northern or steep slope of the Downs sandstones occur, and they are frequent throughout the Weald. Hence flint is rarely used north of the Downs. The chalk district contains 162 parish churches which have more or less retained their mediæval character. With five exceptions, they are of twelfth or thirteenth century foundation. Probably in all, flint forms the mass of the walling, but it is not used architecturally except in a few later insertions. In the fifteenth-century churches knapped and squared flints are largely used, and chess-board panelling, but, with the exception of a few simple crosses, it is believed ornamental work such as occurs in the eastern counties is entirely absent. The exceptional churches are the Collegiate Church of Arundel, the cruciform churches at Poynings and Alfriston, St. Thomas-a-Becket, Lewes, and the little village church of Racton. There is a fourteenth-century Lady chapel and a fine transept window at the Cathedral, and some work at St. Mary's Hospital, at Chichester, but no parish church of the district is of that date.

⁂ Mr. Baggallay desires to state that the illustrations to his Paper, which are simply enlargements of note-book sketches made by himself, should not be regarded as measured drawings.

109. *Clerestory - Coddenham Church*

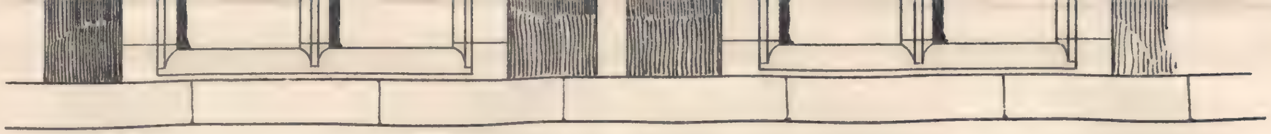


110. Clerestory - Framlingham Church

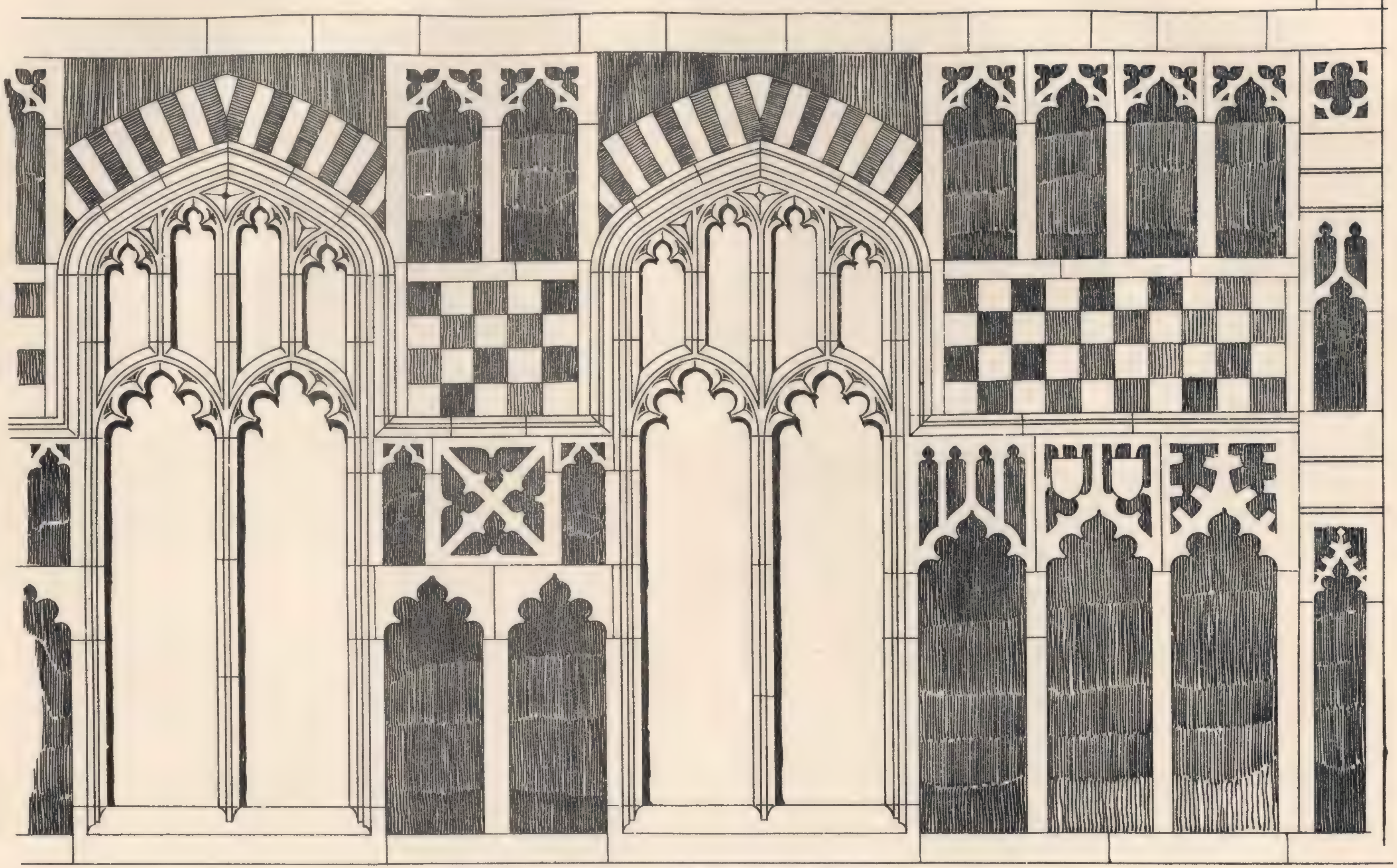
111 Clerestory - Earl Stonham Church

J. F. Kell, Photo-Litho Castle St Holborn, London, E.C.

112. *Clerestory, Saxmundham Church*



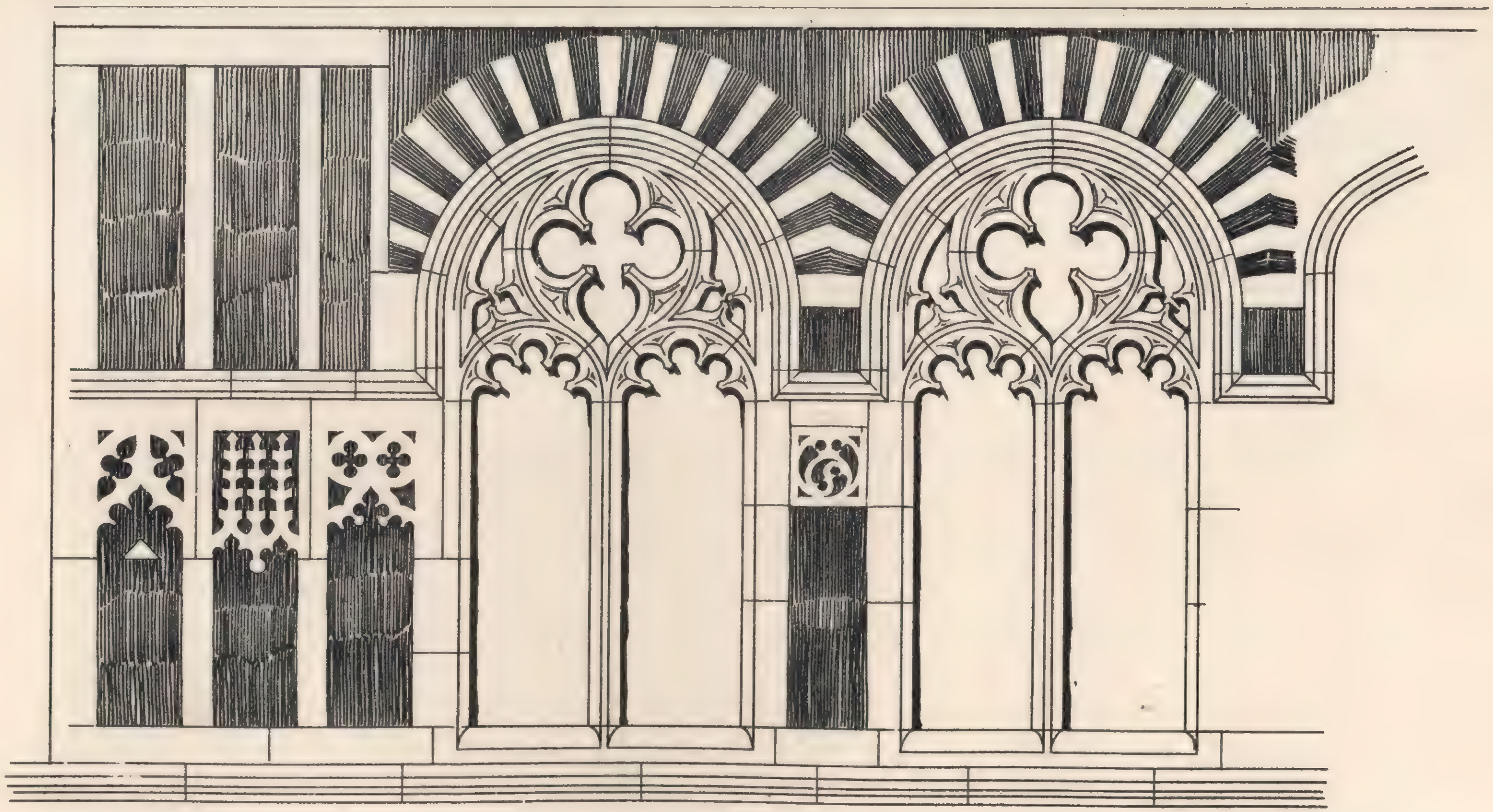
113. *Clerestory - St Clement Ipswich*



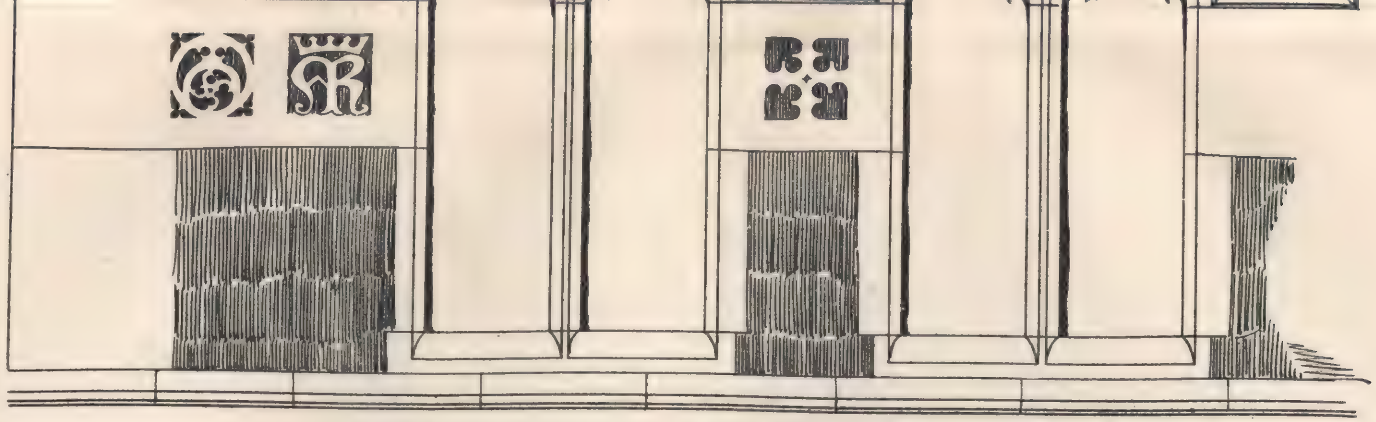
114. *Clerestory Woolpit Church*

C.F. Kell, Photo-Litho. Castle St Holborn, London. E.C.

VIII. THE USE OF FLINT IN BUILDING ESPECIALLY IN SUFFOLK. (xlii).



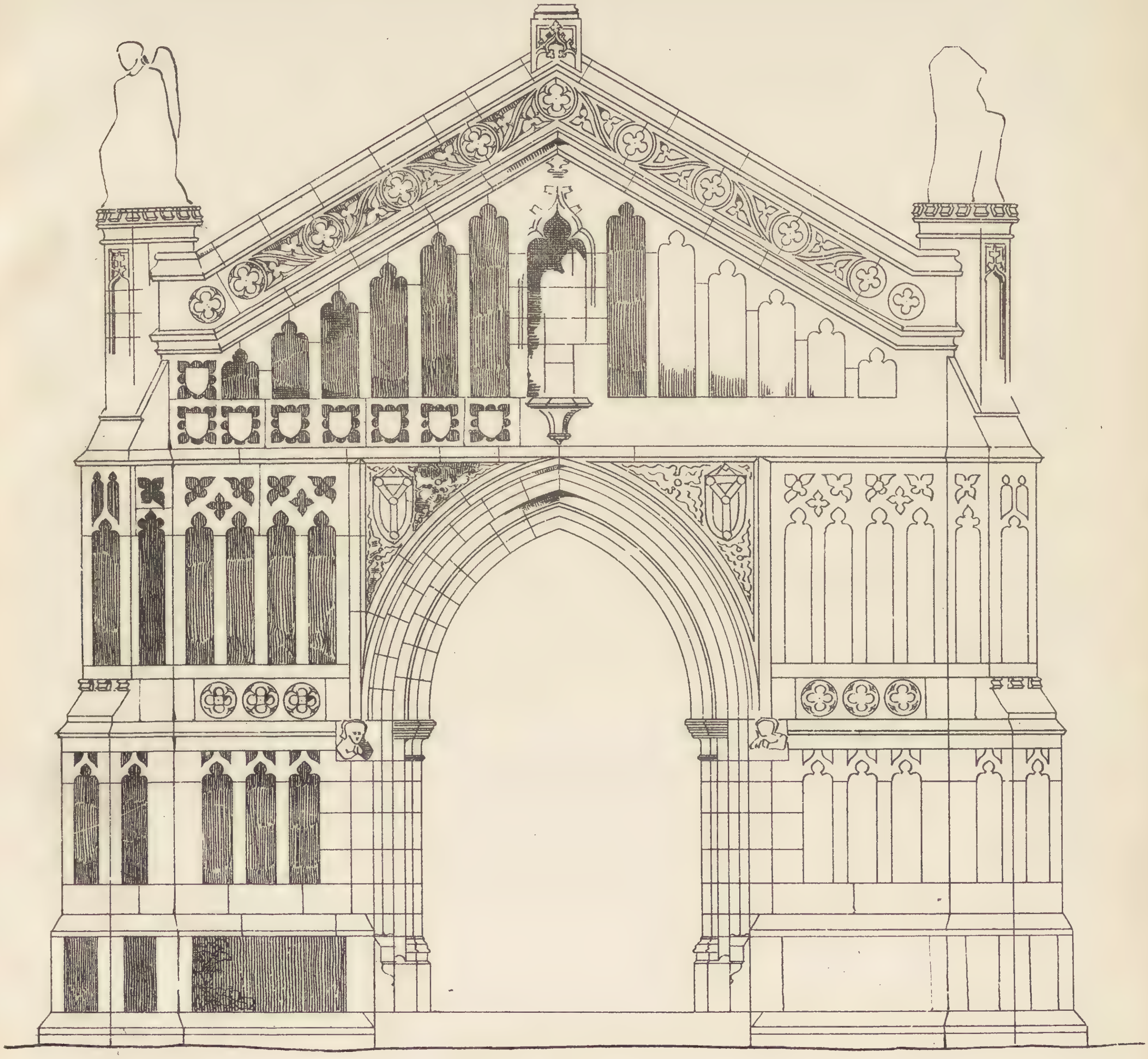
115. *End of South Clerestory Walsham le Willows*



116. *North Clerestory - Walsham le Willows*

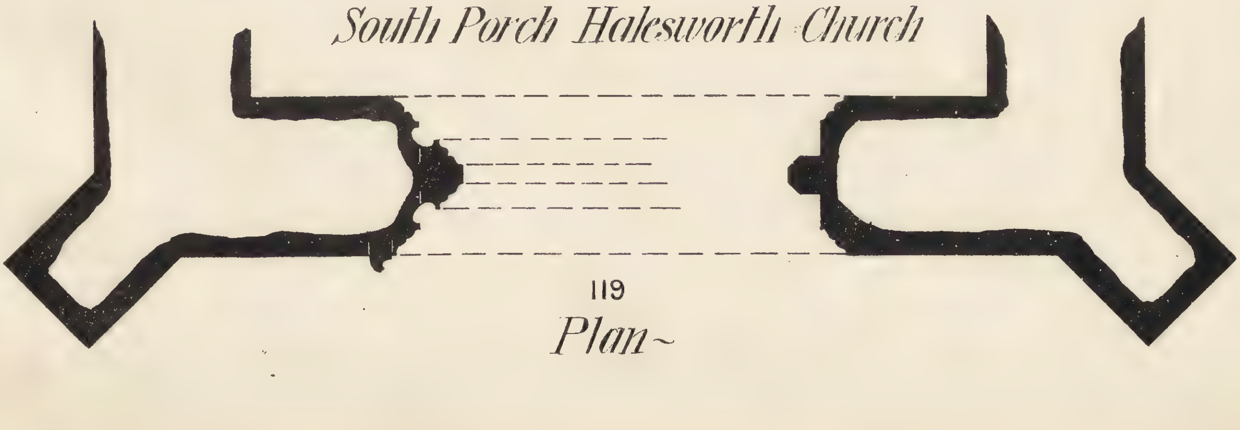
117. *Clerestory - Bacton Church*

C. F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.



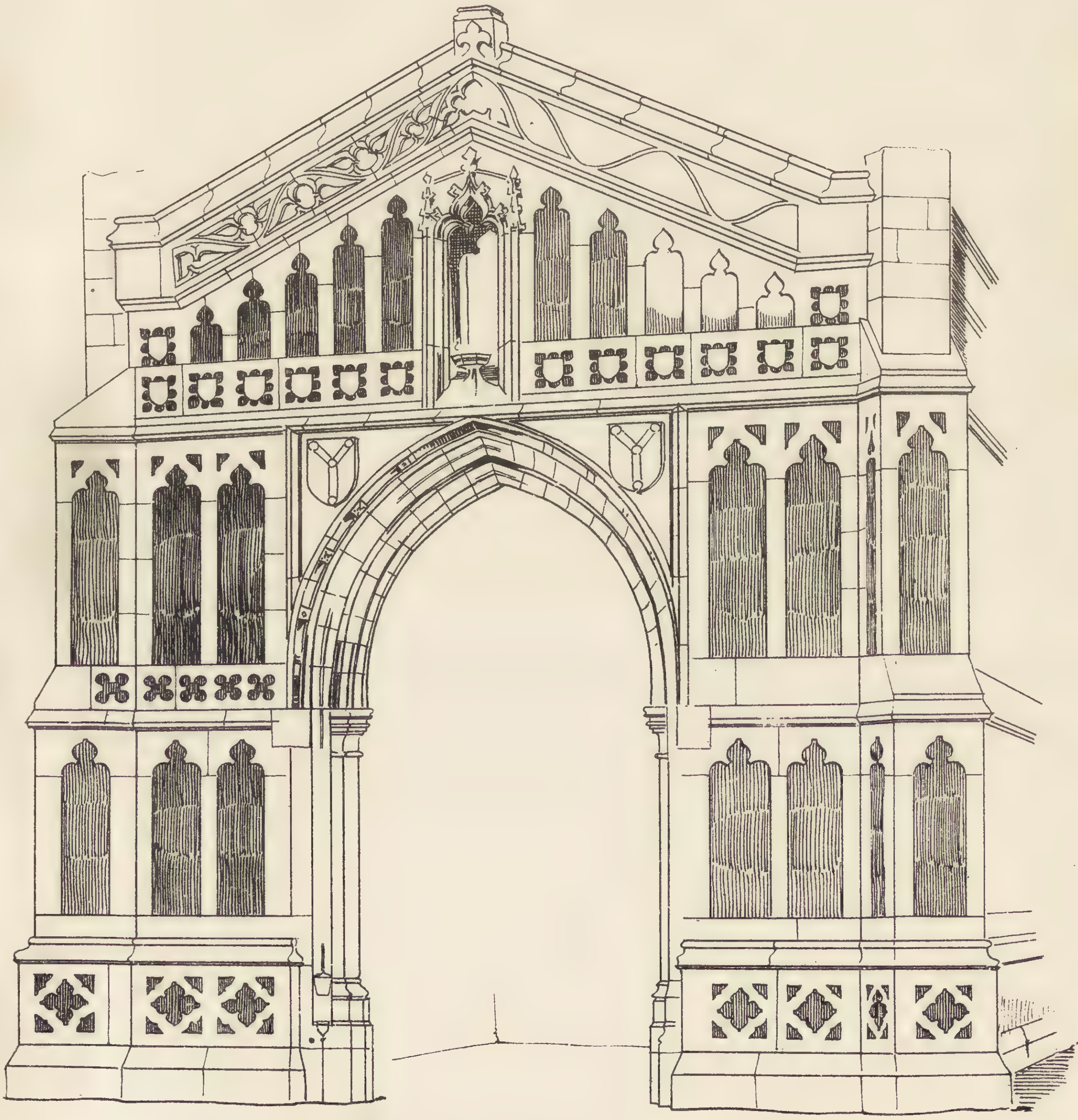
118

South Porch Halesworth Church

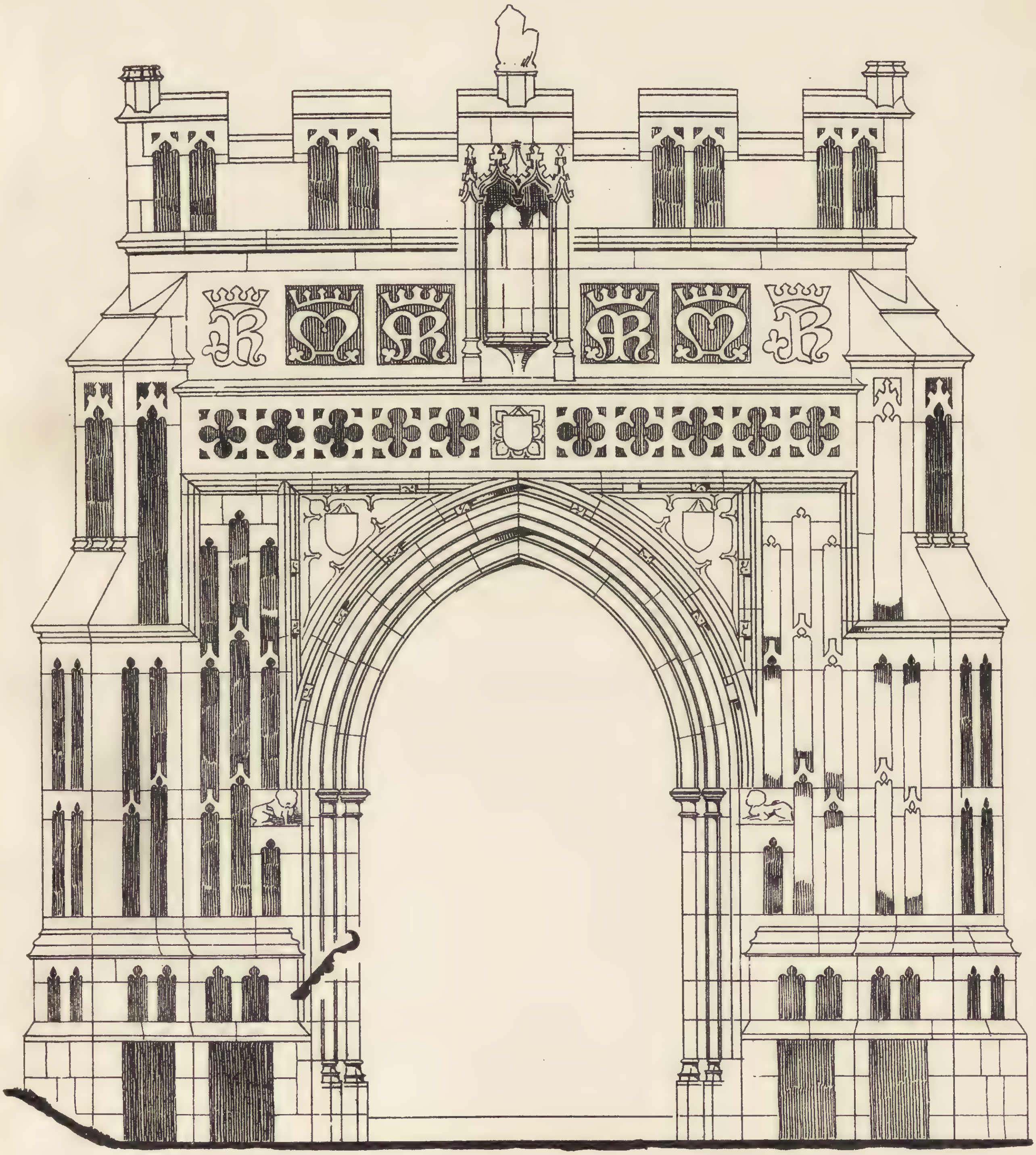


119

Plan~

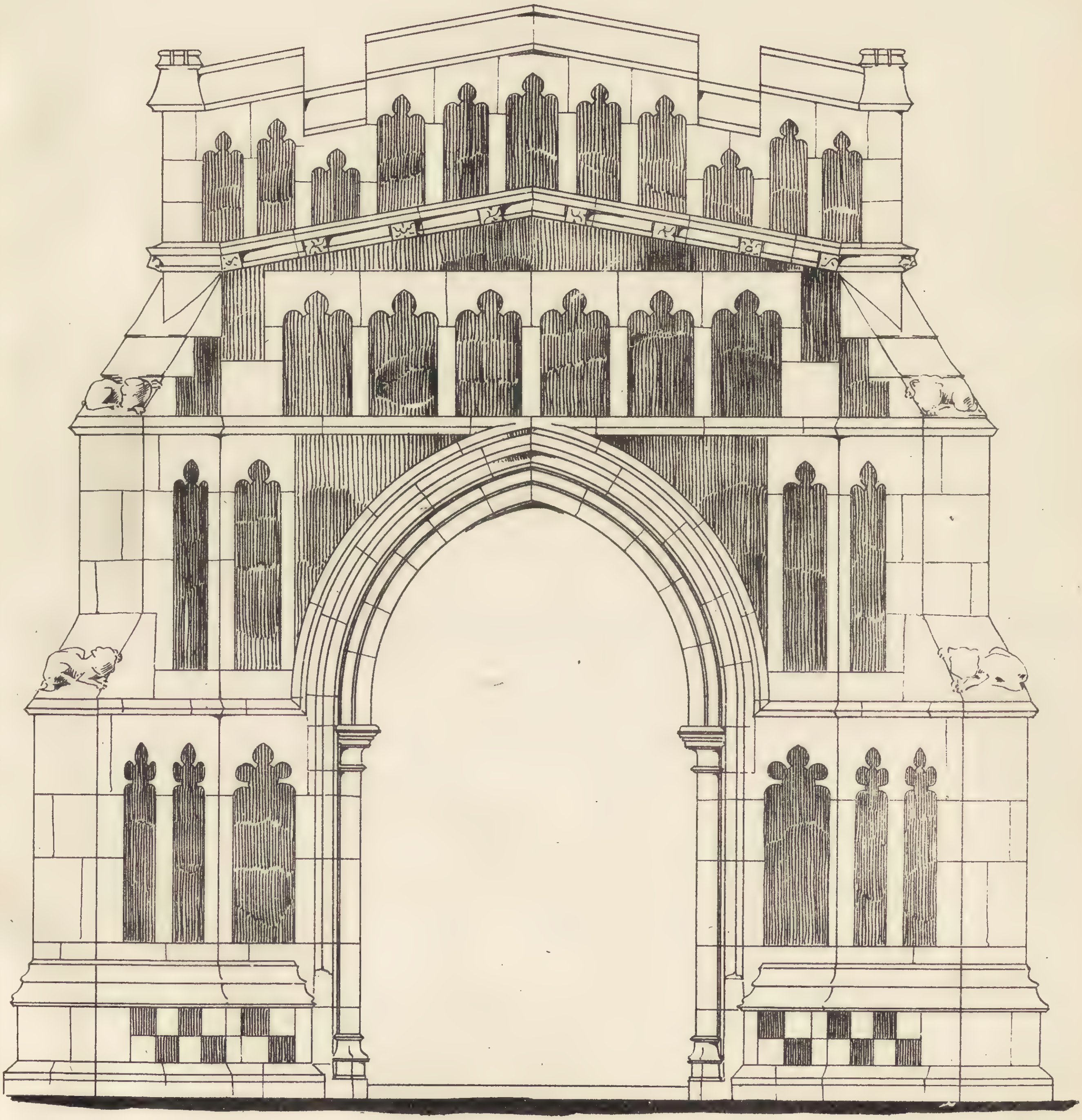


120. *South Porch Blythford Church*



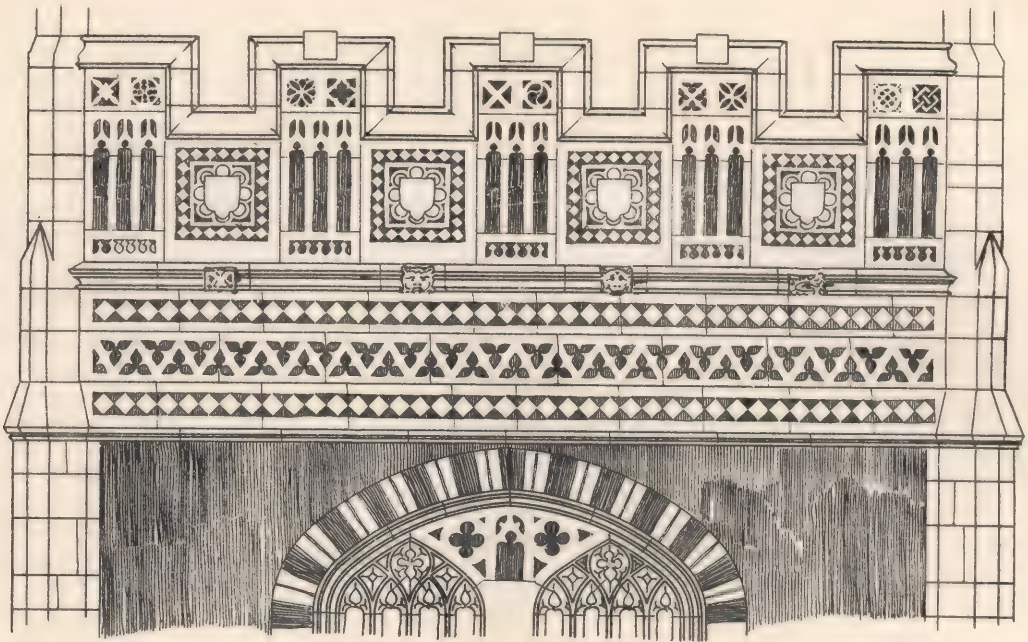
121. *South Porch Mendlesham Church*

C.F. Kell, Photo-Litho. Castle S! Holborn, London, E.C.

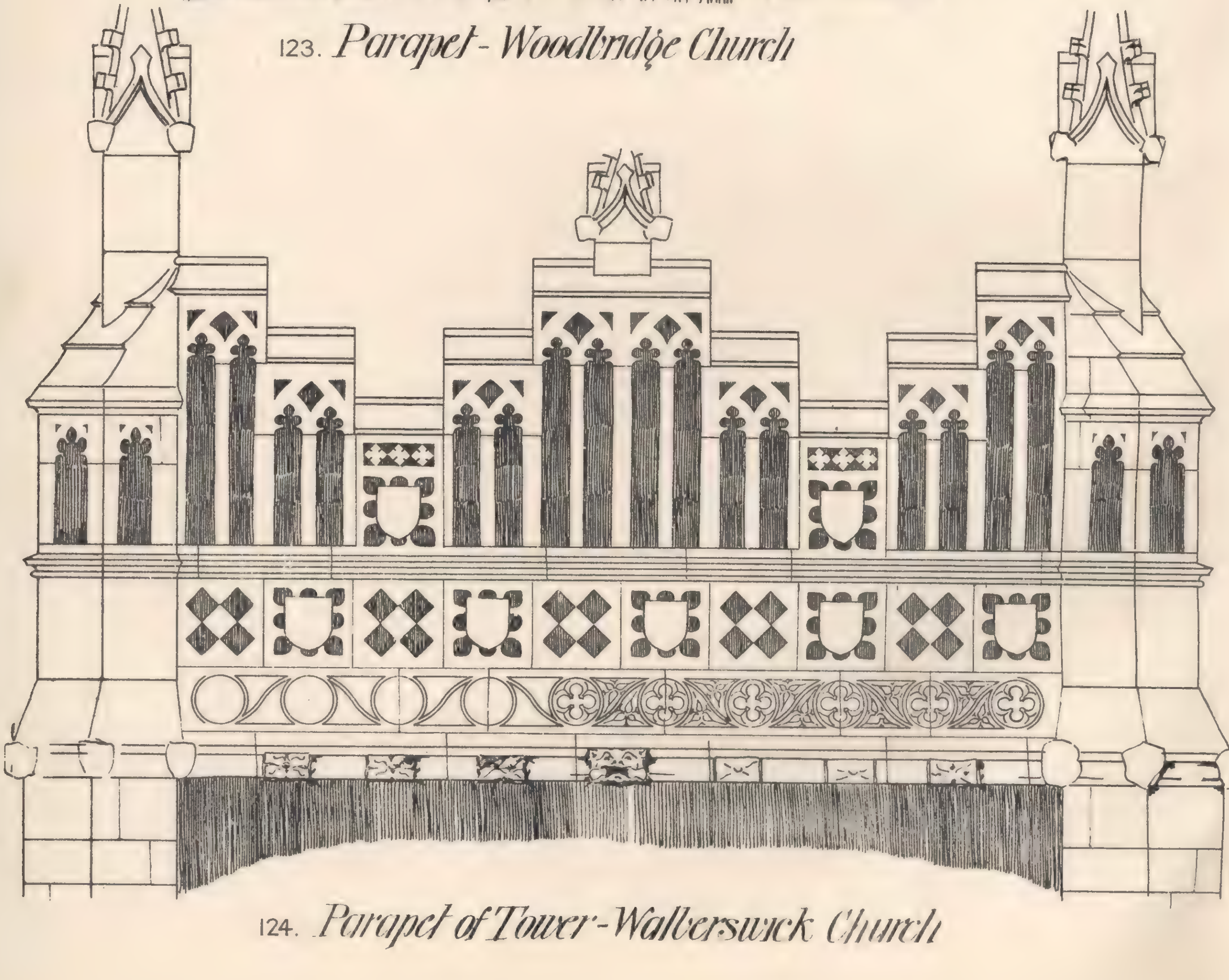


122. *South Porch Ixworth Church*

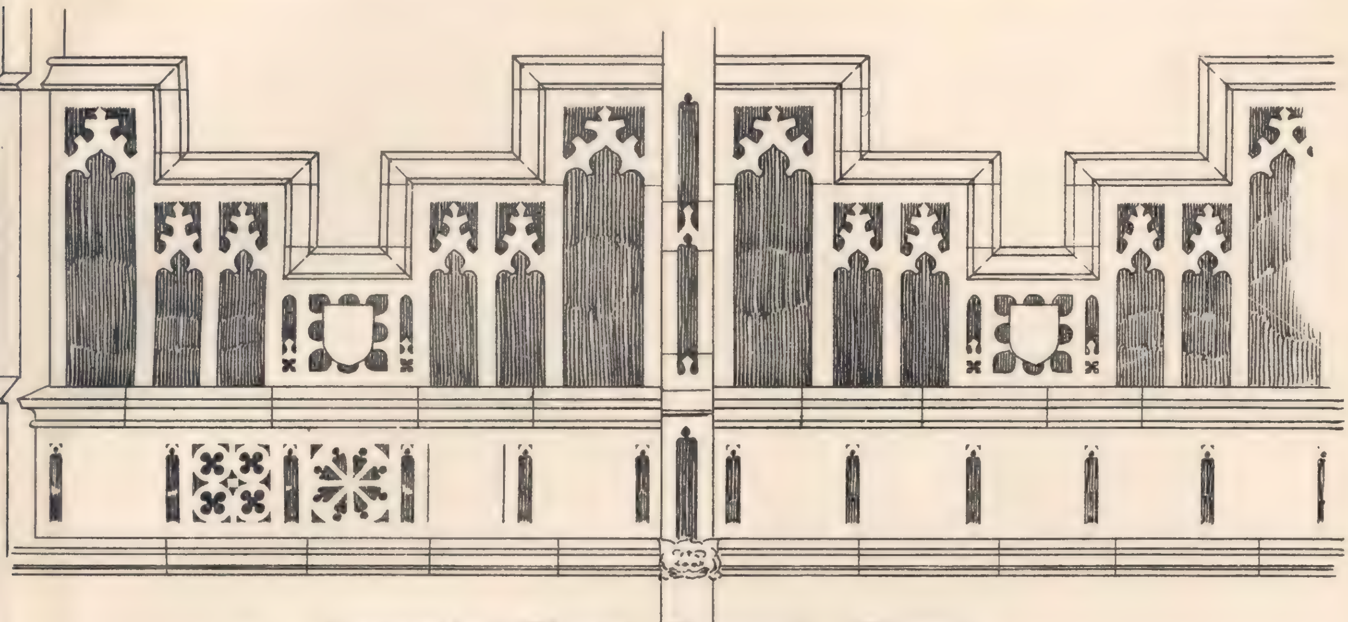
C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.



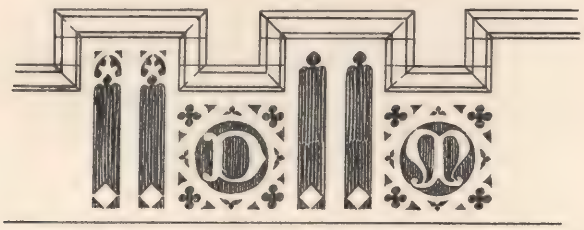
123. *Parapet - Woodbridge Church*



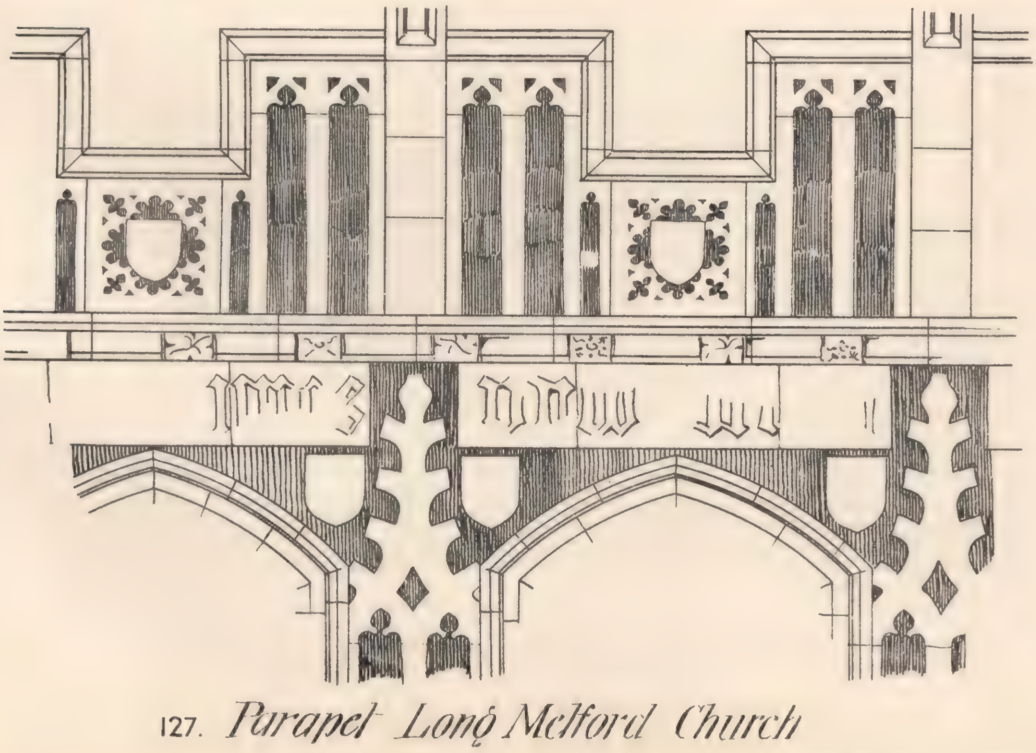
124. *Parapet of Tower - Walberswick Church*



125. *Parapet of Tower Ixworth Church.*

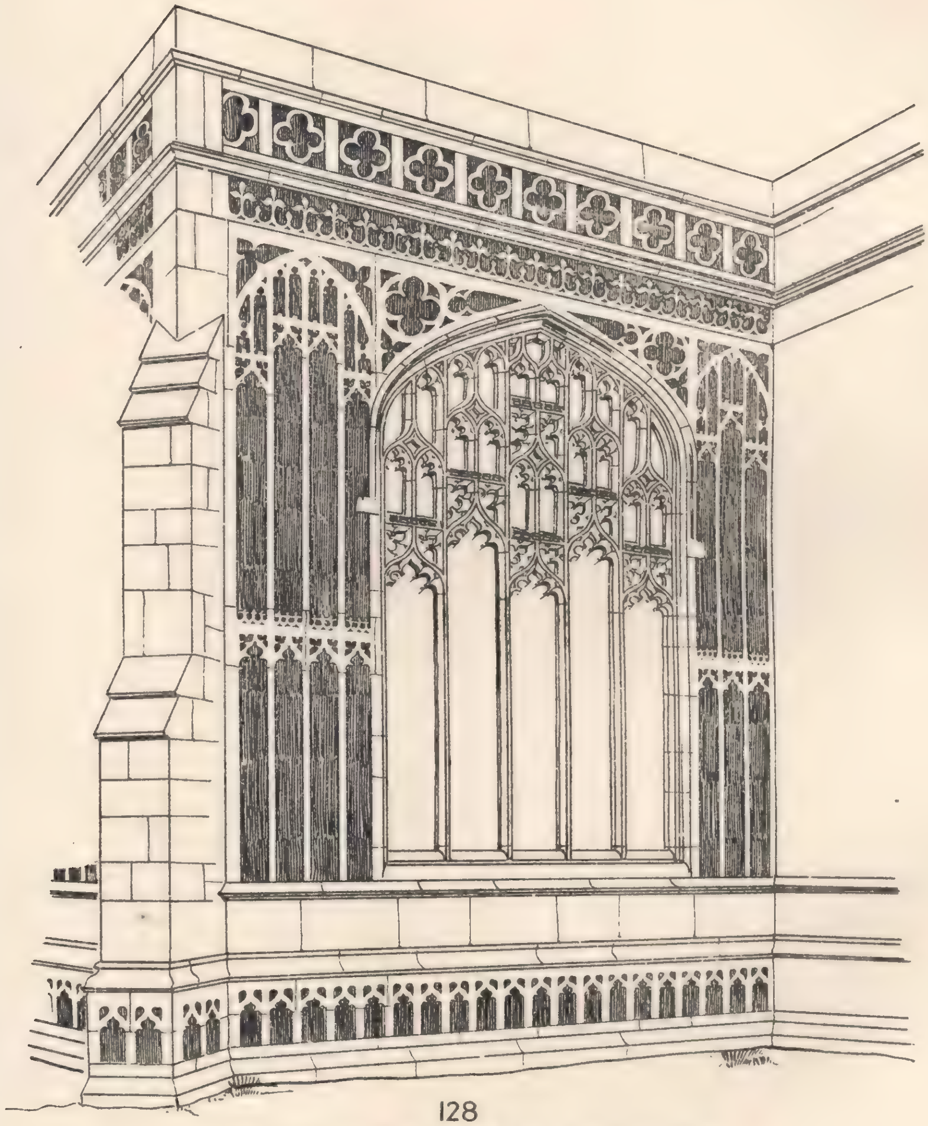


126. *Parapet of Fornham All Saints Church.*



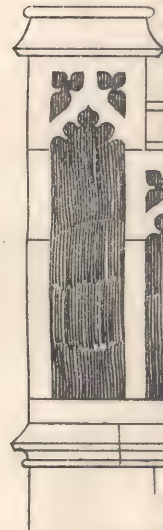
127. *Parapet Long Melford Church*

C.F.Kell, Photo-Litho, Castle St Holborn, London, E.C.

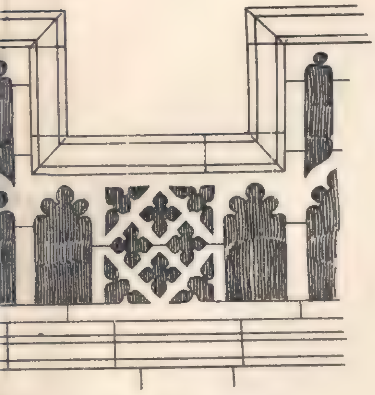


128
*Thorpe Chapel - St Michael Coslany
Norwich*

129.



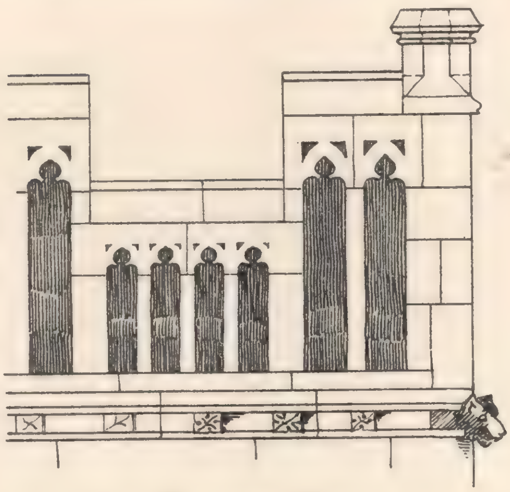
130.



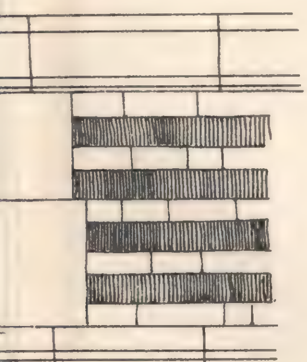
ALESWORTH CHURCH

132. BLYTHFORD CHURCH

ODDENHAM CHURCH



133. HEIGHAM CHURCH



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C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

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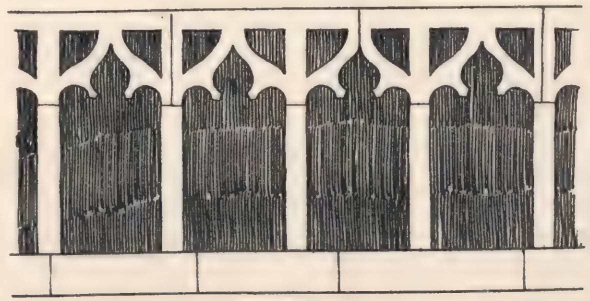

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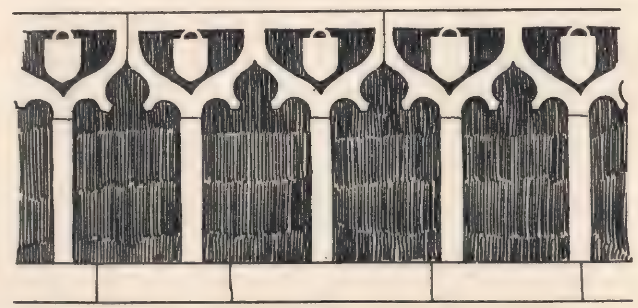

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Cromer Church

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S^t^ Lawrence Maddermarket
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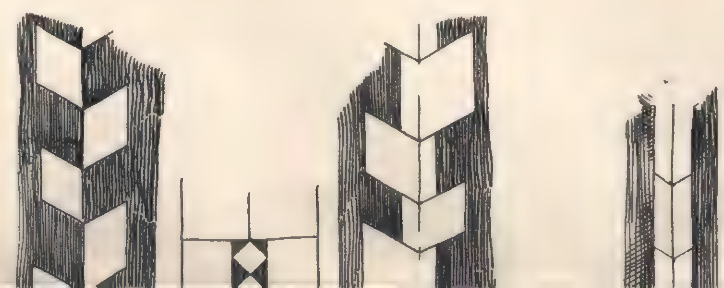
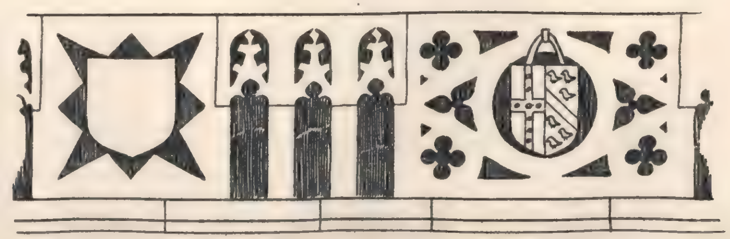
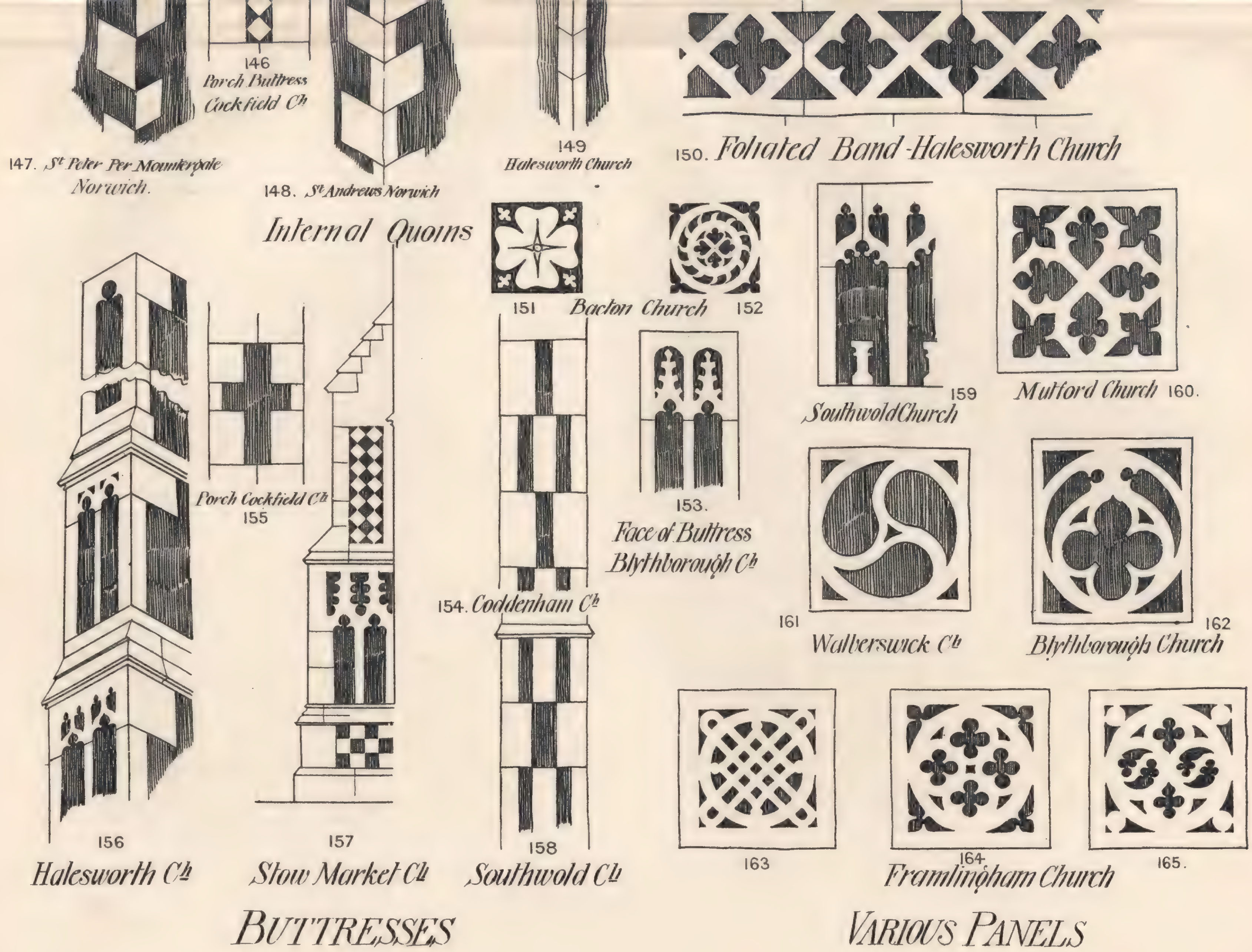
144. Wetherden Church





145. Wetherden Church



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IX.

REMAINS OF THE ROMAN OCCUPATION OF NORTH AFRICA, WITH SPECIAL REFERENCE TO ALGERIA.

By Alexander Graham, *Fellow*.

[Read on Monday, 18th May 1885, Ewan Christian, *President*, in the Chair.]

THE title of this paper might convey the impression that all the monumental remains of the great Roman colony of North Africa were to be the subject of consideration during one short evening. Indeed, I should be acting unjustly by the large store of materials at my disposal, and should be undervaluing their importance as illustrations of a long period of architectural history, if I were to attempt anything more than an outline of the subject, with a description of some of the principal monuments still remaining in a portion of the country.

It seems strange that but few British archæologists and architects have been attracted by so large a field for research as North Africa. The primitive races, the Phœnician, the Carthagenian, the Roman, the Byzantine and the Arab, have each in their turn left innumerable records of their presence; and it is not too much to say, in the absence of any continuous literature on the subject, during a period of 2,500 years, that there is material in stone and marble scattered over the vast area extending from the borders of Egypt to the Atlantic Ocean, and a wealth of inscriptions, many of which still await the labours of the explorer, sufficient to enable a careful observer to write a fairly faithful and continuous record of the nations and monuments of North Africa. The history of the country may truly be said to be written on stone. The writers of antiquity who have recorded their impressions are numerous enough, but their statements are not always accurate, nor are their descriptions of monuments to be relied upon. Herodotus, Sallust, Strabo, Pliny the younger, Plutarch, the Spanish geographer Pomponius Mela, and even some of the writers of the Old Testament, derived much of their information from no personal knowledge of the country and its extent, nor from acquaintance with the various races that inhabited it. In later times we come to Procopius, the Greek secretary attached to the army of Belisarius, Leo Africanus, and numerous Arab authors. From no one do we get more than a glimpse of the cities

of North Africa, nor of its monuments conspicuous for their beauty as well as number and variety. Then after a long interval we have, in the last century, a succession of travellers whose voluminous notes paved the way for the commendable researches, in recent times, of a line of French authors and antiquaries. But of these travellers not one was a painter or an architect. Shaw was an Oxford divine; Peysonnel, a doctor of Medicine; Bruce, British consul at Algiers; Desfontaines, a professor of Botany; Sir Grenville Temple a cavalry officer. It seems invidious to select a few names where so many are worthy of recognition, but the labours of those who have best served the cause of archæology, and are inseparably connected with the literature and monumental remains of North Africa, cannot be passed over. The contributions of Berbrugger, Delamare, Guérin, Ravoisié, Pelissier, Cherbonneau, and Léon Renier, in the present century, furnish us with most valuable information on the general antiquities of the country. To Delamare we are indebted for an illustrated, though unfortunately incomplete, edition of monumental Algeria. To Ravoisié we owe some careful measurements and restorations of some of the principal remains in the north of the country, and to Renier and others a wealth of deciphered inscriptions which contain of themselves a fair outline of the history of this great Roman colony. Perhaps to our own Bruce we, as architects, are under greater obligations than to any other traveller. His careful drawings, executed in a manner that showed artistic skill as a draughtsman, and a thorough knowledge of architectural detail, are familiar to us in Col. Playfair's delightful work entitled "Travels in the footsteps of Bruce," the subject of special and well-merited commendation by Professor Donaldson in 1876, and duly recorded in our TRANSACTIONS. The researches also of officers attached to the "Bureau Arabe," which are too numerous to mention, have filled up many gaps in the history of Roman Africa, and have resulted in a mass of information that cannot fail to be of service to any future historian. Notwithstanding this flood of antiquarian literature, there cannot be said to be any continuous history of the colony as recorded by its monuments. Such a history remains to be written, one not only embracing the five centuries of Roman occupation, but the early career and struggles of the Christian Church in North Africa. For the illustration of the last period there is abundant material; a period when the temple and basilica were to become the home of a new ritual, when the sculptured deities were to be overthrown, when the symbols of a despised creed were to be carved on post and lintel, and when the names of Tertullian, St. Cyprian, St. Augustine, and other fathers of the African church, were to add new lustre to a country entering upon the last stages of Imperial decay. As a prelude to this enquiry, and in the hope that some of my enterprizing brethren may be induced to follow up a subject of more than ordinary interest, I have penned my first series of notes on the monumental remains of North Africa.

Let us glance at a map of the southern shores of the Mediterranean at the close of the Third Punic War, B.C. 146 (for it is at this period that the history of Roman Africa commences), and let us see how the country was divided, and what were the races that were either to be crushed by, or in the course of two centuries absorbed into, the vast

Roman Empire. Commencing westward of Cyrene, a Greek colony founded some three centuries previously, and though afterwards part of the Empire yet never recognized as belonging to North Africa, we come to Africa proper, the little corner that is known as Africa Provincia in ancient maps, of which the capital was Carthage, and then to the country of the Libyans, divided between the Massylians on the east and the Massæsylians on the west, stretching round to the shores of the Atlantic.[48] Both these nations received from the Romans the name of Numidæ, from the Greek νομάδες, signifying wandering habits. Thus Masinissa, who ruled both nations at the time of which we are speaking, assumed the title of King of Numidia.[49] We know also that Sallust, as Roman Governor of the Kingdom of Numidia, at the close of the Jugurthine War 50 years later, styled himself Governor of Numidia. Now all this vast region had been, till the approach of the Roman, under the control of the Carthagenians. The career of these ancient rulers of North Africa, illustrious from their spirit of adventure, unflagging energy and wondrous commerce, is a chapter of romance. Hemmed in originally between the mountains and the sea on the Syrian coast, this little Phœnician colony spread itself in a comparatively short period along the whole seaboard of the Mediterranean, then passing the Pillars of Hercules it reached Sierra Leone in the south, eastward it touched the coast of Malabar, and the German Ocean was not beyond its northern limits. Strange that these Canaanites or Phœnicians, the scorn of the Israelites, and the people against whom Joshua bent all his powers, should have had such an unchecked career, making themselves sole navigators of every sea, and holding within their grasp the commerce of the then known world.[50] Through their hands passed grain and ivory and skins from Libya, slaves from the Soudan, purple and cedar from Tyre, frankincense from Arabia, copper from Cyprus, iron from Elba, tin from Cornwall, wine from Greece, silver from Spain, and gold and precious stones from Malabar. A nation of traders and navigators it was on the coasts they settled, and wherever they settled they there established depôts and factories. We never find them in the interior of a country, nor do we ever hear of alliances with the people with whom they came in contact, nor of their impressing barbarian tribes with any notions of the advantages of civilization. In the field of intellectual acquirements the

[48] The Greeks, in the time of Homer, knew North Africa as Libya; and, according to Herodotus, some four centuries later, discredited the statement that the Phœnicians had circumnavigated the country. The Persians, who had extensive commerce with the Phœnicians, believed it; and we are told that Xerxes pardoned Sataspes, a criminal condemned to death, on the condition that he made a voyage round Africa. Sataspes started on his journey, but returned quickly, pleading as an excuse that he met with fabulous monsters in the Straits of Gades. Xerxes disbelieved the story, and ordered Sataspes to be impaled forthwith.—A. G.

[49] Masinissa, who died 148 B.C., deservedly occupies a conspicuous place in Roman history. Although a barbarian, he was free from the crimes so common among uncivilized tribes. Fearless in war, generous in disposition, a good statesman, and firm in loyalty to his Roman allies during an unusually long life, Masinissa may fairly be considered the hero of Numidia. Like all his race he drank nothing but water, and at the age of 90 was able to jump on his horse bare-backed. He left 44 children.—A. G.

[50] Procopius informs us that when Joshua invaded Palestine, the tribes who dwelt on the coast between Sidon and the borders of Egypt (the Gergesenes, the Jebusites, and others mentioned by Hebrew writers) abandoned their country to escape the invader, and crossed Egypt into Africa. Here they spread themselves as far as the Pillars of Hercules, and established numerous towns, where the Phœnician tongue

Carthagenian has no place, and his skill in the gentler arts of life has no recognition.[51] We find no Phœnician architecture, nor do we hear of any industrial art worth recording. Carthage, it is true, became the metropolis of their wide-spread kingdom, and one of the wealthiest cities of the world. These it owed to its central position, and to its being the most convenient outlet for the vast produce of North Africa. Temples and stately edifices adorned its streets, and the remains of great constructional works still attest the solid grandeur of the city. But the architecture was the work of Greek, not of Punic, artists, and the few sculptures of note, which may be assigned to a period anterior to the last Punic war, have nothing in common with the rude carvings that bear the impress of Carthagenian origin. On the other hand the art of navigation, the principles of trading, and the system of water-supply, with the establishment of those gigantic cisterns that may still be seen at Carthage, and on the outskirts of nearly every town in North Africa, became Rome's heritage from Phœnicia. But this was all.

It is necessary to mention these facts in order to meet the supposition that Roman art may have received new influences when transferred to African soil, and that increased vitality resulted from the fusion of these two races, so dissimilar in type and origin, and who strove so long and desperately for the mastery of the world.[52] There was a time when a Carthagenian general had forbidden the soldiers of Rome to wash in the waters of Sicily. Now it was the entire Mediterranean and all its coasts that were to be for Rome and the Romans only. Slowly but steadily did the all-conquering invader accomplish his task. With the fall of Carthage fell also all the commercial ports from Cyrene to the Pillars of Hercules. Rome in her turn was to become mistress of the sea, and to grasp the carrying trade of the world.[53] Again, specially directing

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continued in use as late as the 6th century. Procopius also adds that the emigrants built a strong castle in a town of Numidia, called *Tigisis.* Here, he says, were discovered two stèles of white marble, bearing this inscription in Phœnician characters : "We are those who fled from the face of the brigand Joshua, "son of 'Navé.'" Suedas testifies to the existence of these slabs. Gibbon believes in the stèles, but doubts the inscription.—A. G.

[51] The library of Carthage, which contained the native records of North Africa, was presented by the Romans to the Kings of Numidia. Sallust made extensive use of it in writing the history of the Jugurthine war.—A. G.

[52] Mommsen, the historian, remarks that both Carthage and Rome in their earlier history were agricultural and mercantile cities, and nothing more. Art and science had the same practical and subordinate character in each. In Carthage the moneyed interest preponderated over the landed. In Rome the reverse. Whilst the agriculturists in Carthage were universally large landlords or slave-owners, in Rome at this period the great mass of the burgesses still cultivated their fields in person. The majority of the population in Rome held property, and was therefore conservative. The majority in Carthage held no property, and was therefore accessible to the gold of the rich or the cry of the democrat. In Carthage there already prevailed all that opulence which marks commercial cities, while the manners of Rome preserved, at least externally, the severity and frugality of earlier times. When the ambassadors of Carthage returned from Rome after the second Punic war, they told their colleagues that the relations of intimacy among the Roman senators exceeded all conception, and that a single set of silver plate sufficed for the whole Senate, reappearing in every house to which the senators had been invited.—A. G.

[53] North Africa became indispensable to Rome as a source of grain supply. The small amount of wheat produced in Italy was only sufficient for the soldiers. War in Africa meant famine in Rome. During his struggles with Cæsar, Pompey stopped the export. Such was the distress in the capital that the

our attention to Numidia, we see Rome sending there, from her Latin colonies, chosen men to develop its capabilities, and it was not long before towns and villages sprang up in its productive plains. An extended system of husbandry was introduced; great constructional works, entitling the Roman to be considered the greatest among builders, met the eye in every direction; military stations were founded on the southern frontier; and when Rome crossed the Aures and descended into the Desert, she established herself and her outposts in the same parallels, and almost on the same spots, as the French army of the present day. This, then, was the great Roman colony of North Africa, with its natural boundaries of sea and sand, its shores astir with commerce, its plains covered with towns and villages and smiling cornfields, its uplands clothed with forests of timber, its southern frontiers guarded by military depôts, and far down over the stretch of trackless sand, where then as ever the caravan threaded its way, did the Roman soldier raise his rough outwork, and mark in imperishable stone the name of his legion, and the distance of that stone from the military centre. I may here mention a remarkable instance of history repeating itself after a lapse of many centuries. It was but the other day that Marshal St. Arnaud, in the French conquest of Algeria, led his troops through a defile of the Aures, and looking down on the great Desert stretched at his feet, he said, in the enthusiasm of the moment,—"We may flatter ourselves we are the "first soldiers to pass through this region." Strange error! He little knew that near where he stood, on the imperishable rock, was an inscription recording how the Sixth Roman Legion under Antonine had made the same journey, and possibly under a like illusion, seventeen centuries before. The Arab says that "the Roman built as though "he were to live for ever," and certainly the Roman mark is an enduring one. The chief monuments of the country may have perished, but its history remains in the thousands of inscribed stones that strew the surface in all directions. It may be that some lettered fragment is unearthed to the nineteenth-century sunshine, and then rolled back to slumber for a few more hundred years; or may be, as occurred the other day, a stone of value is accidentally uncovered and thrown to the wayside to await the advent of the next explorer. Passing through Algiers scarce three months ago, M. MacCarthy, the learned librarian and curator of the Museum there, placed in my hands a little

populace implored Cæsar to terminate his differences with his rival. A treaty was arranged, the chief condition being that Pompey would let the grain ships leave the African ports. Cæsar himself was so struck with the fertility of the soil that, on his return from Africa, he declared the Roman people might draw from it annually 200,000 bushels of corn and 3,000,000 pounds weight of oil. The town of Leptis alone was condemned by him, according to Plutarch, to pay a fine of 2,500,000 pounds of oil; and Hirtius tells us this was a very moderate demand. Tacitus also mentions that Vespasian, in disputing the throne with Vitellius, conceived the project of invading Africa by sea and land, and seizing the granaries. On the death of his rival he charged with wheat every ship in the Empire. The Emperor Commodus was the first to build a fleet of ships for this purpose. He had an African and an Alexandrian fleet. It was in a ship of the latter, the Castor and Pollux, in which St. Paul embarked from Malta. In the time of Constantine the wheat from Egypt was shipped entirely to Constantinople, and the wheat of Africa supplied the Roman markets. M. Renier discovered at Guelma an inscription of the time of Trajan, showing that a functionary was charged with the control of the grain supply for the metropolis. The office was one of considerable importance.—A. G.

pamphlet bearing the title COLUMNATA. "Look!" said he, with all the enthusiasm of the antiquary, "All this is about one stone which we have been seeking. It fixes "the site of a Roman town, the position of which we have hitherto been unable to "define." Memorials of Roman occupation, fragments of sculpture or architecture, present themselves sometimes where least expected. Thus, journeying up the mountains to the Arab city of Kef, in Tunisia, partly for the purpose of catching a glimpse of one of the great battle-fields of history, the fatal plain of Zama, I found the remains of Roman military posts and of farm-houses in arid spots where stones and grass are now striving for the mastery.[54] And here, too, in this walled town, a veritable city in the air, an excrescence on the rock, I was shown, near the fragmentary remains of a temple of gigantic proportions, the white marble statues of two emperors and an empress, unearthed within the last six months from their long resting-place. They were found 10 feet below the surface. As they were headless and two were without arms, identification was impossible, but further exploration will probably result in the discovery of the missing portions. It may be true that the Roman built as though he would live for ever, and in the hope that his work would stand the wear and tear of countless ages, but he little calculated on centuries of neglect and abandonment, of natural decay, of the changing of the earth's surface, of earthquakes innumerable, and of destruction for destruction's sake by the barbarian Vandals. It is unfortunately true that some of the chief monuments of North Africa have perished, and the very sites of some of the towns are unknown, but their fragments are everywhere, and tell the tale of ruin and destruction. Inscribed stones, many of them as sharp as when they received the last touches of the mason's chisel, strew the surface, imperishable memorials of some emperor's triumphal progress, of some public career and its responsibilities and exactions, and, once at least, of an architect who, in time of trouble, laid-by the rule and the pencil to unsheath the sword in defence of his country—

D. M. S
M CORNELIVS FESTVS
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ARCHITECTVS VIC
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I cannot claim for any of the monuments I have seen a very high place in architectural art, nor can I submit them to your notice as objects of any special artistic merit. They are subjects for study rather than models for imitation. They show the gradual development of Roman architecture during the later years of the Empire, and connect it with more than one succeeding style, thus necessarily exhibiting many instances of departure from the stern teachings of Vitruvius. It is difficult to assign a precise date to many of the principal remains, owing to the loss or fragmentary condition of inscriptions,

[54] The battlefield of Zama is mostly in Tunisian territory. It lies between the towns of Kef, Taoura and Kalaät-es-Sanan. The nearest town is Naragarra. Sallust, speaking of Zama, says "urbem magnam "et in eâ parte quâ sita erat arcem regni, nomina Zamam." Hannibal's camp was south-east of Naragarra. In his rear was the river Mellegue.—A. G.

and the complete absence of literary records. The earliest structure in that portion of the colony now under consideration may be assigned to the time of Vespasian; many, judging from numerous inscriptions, to the reign of Trajan; and to his successor Hadrian, the greatest builder of all the Emperors, a large number of constructive works, but no monuments of any importance, belong. To the eventful reign of Septimius Severus, a Libyan by birth, under whom the colony attained its greatest splendour, we may credit the largest number of important monuments. Although several buildings in North Africa erected during his reign may be referred to as examples of Roman architecture at the commencement of the third century, one is fain to admit that classic architecture, as an art, was then in its decline, and to agree with M. Choisy in a work entitled *L'Art de bâtir chez les Romains* " that from the reign of Augustus the process, so to say, of architecture " was fixed, and the art of construction became stationary at its highest point. But, step " by step, decoration and structure became almost independent one of the other. Thus " each obeyed in their development or decline different laws. Construction under the " Antonines did not differ from what it had been under the first Cæsars, although archi- " tecture was essentially modified during the century that intervened. At the close " of the third century architecture was in full decadence, although the art of building, " still flourishing, produced such gigantic edifices as the Baths of Diocletian." There is abundant testimony of this progress of the building art even in North Africa. The largest remains are those of the great *Thermæ*, and the greatest triumph of building construction is the aqueduct of Carthage that stalks across the vast plain on the south of the city with a majesty which is perhaps without an architectural parallel. I here wish to remark, as having a side bearing upon the gradual change in classic art, that in more than one city in North Africa, where the remains belong to the first century, Greek characteristics are observable, and it was in these cities that colonies of Greek artists resided. While, in the border towns that formed at a late period the military strength of the Empire, we are struck with the gigantic proportions of many of the edifices, and a prevailing coarseness in the detail and ornamentation.

Before we can, with due instruction to ourselves, track the Roman on his gigantic mission of construction in Numidia, it is essential to note the distinction between the different classes of towns throughout the colony. I have prepared a map [Illustn. 1], based on Champlouis's official chart, showing the positions of all the principal towns in the colony in the age of the Antonines, supplemented by a tabular list giving the Roman name and the present designation of these towns, and have marked with a black line those that were raised to the dignity of Roman *coloniæ*, the rest being *municipia* only [see table at end of Paper]. In order to make this list complete, no less than 620 towns might be named altogether, but of these a large number would be classed as villages rather than towns. The success of the Romans as colonists has not been surpassed by any other nation. The Roman people under the Republic, and afterwards under the Cæsars, were at the same time soldiers and colonists, and, it has been observed that " they were like a highly- " trained and well-disciplined body, in which all the parts worked together. Recipro- " cating in work and will they acted in a double character, offensive and defensive,

" organized to resist revolt, to command and protect the countries subdued, to teach " Roman ways and habits, and to allow the free exercise of religious rites." The members of these *coloniæ* formed a sort of patrician caste, the heads of families retaining their rights as Roman citizens, with the privilege of recording their votes in Rome in the public assemblies. The *municipia,* during the Empire and in later times, were under certain obligations to provide a contingent of troops in time of war, exercising the civil or private rights of Roman citizens, but having no part in the popular elections. There were many other distinctions we need not inquire into here. It is sufficient to add that Latin *coloniæ* had no place out of Italy; that Roman *coloniæ* took the highest rank in other parts of the Empire; then came the *municipia,* and lastly the free towns and villages. In both *coloniæ* and *municipia* Roman laws prevailed.[55]

The starting point in any historical account of North Africa under the Romans is Carthage, for it was here they landed, making it the seat of civil government for 500 years, and the focus of a network of roads that extended ultimately to the Desert line. Unfortunately all I can propose to do, in the short space of one evening, is to give a summary of the more important remains in that portion of the country now known as Algeria, comprizing the provinces of Constantine, Algiers and Oran, corresponding with the Roman provinces of Numidia proper, Mauritania Sitifis and Mauritania Cæsarea. The boundary on the north is the Mediterranean, on the west the barren mountainous district now known as the Riff country, and never peopled at any time, on the south the Sahara, and on the east an irregular frontier somewhat difficult to define. This eastern boundary scarcely corresponds with that which formerly separated Numidia from Africa Provincia (so called), for there is a large strip of country west of that boundary, which, since the Arab invasion in the seventh century, has always been recognized as part of Tunisian territory, and the inhabitants of which have paid tribute in some form or other to the Bey or other ruler of Tunis; but in Roman times, and even later, this tract formed a portion of Numidia. I have recently travelled along this old frontier. Striking the coast at Tabarca, following the course of the Oued-el-Kebir into the centre of the Khomair country, and then crossing the plain of the Medjerda, I was able to mark the Roman posts nearly all the way to Tebessa, at the foot of the Aures. In this strip of territory are the ruined cities of *Simittu* and *Bulla Regia,* the latter having been once the residence of Numidian kings. To avoid confusion, however, in the division of the subject, it will be as well to adhere to the modern frontier line, which is clearly defined on official charts. Taking the towns in a geographical order, commencing with those on the coast, we can supplement this general survey by more detailed description of some few examples possessing strikingly instructive and suggestive features.[56]

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[55] Romans convicted of crime were not allowed to settle in Africa for fear they might ally themselves with native tribes.—A. G.

[56] The positions of most of the towns are ascertained from the Tables of Ptolemy (time of Hadrian), the Chart of Peutinger, now at Vienna (date uncertain, but probably about the middle of the 4th century), and the Itinerary of Antonine (posterior to the time of Constantine, but not written by the Emperor Antoninus, nor composed by his orders). These are about the only works in which distances are given.—A. G.

With two exceptions, the coast towns have little remaining for our consideration, however interesting their sites may be as matters of history. But we cannot pass by without notice the site of *Hippo Regius*, the *Ubba* of the Carthagenians, the *Hippone* of the Romans, and the scene of the life-long labours of St. Augustine. What the Vandals did not reduce to ashes the Arabs did two centuries later, and with the stones of the Roman city the modern town of Bona, one mile and a-half distant, was constructed. Nature has dealt very kindly with this hallowed spot. The hills where the Romans marched are now clothed with perennial verdure, while, above the soft covering, grey fragments of Roman wall still rear their heads into the blue air, sweet with perfume, for nowhere in all Algeria do the trees put forth their leaves in wilder luxuriance, the olive and the aloe, the acanthus and the pomegranate. And this peaceful shaded spot was once the capital of Eastern Numidia, second only to Carthage as a commercial city, and the home of the chief Father of the early Church of Africa. This is Nature's memorial to one who combined the courage of the Roman with the spirit of the true Christian.

Journeying westward we come to *Rusicada*, built by the Romans on the site of the Phœnician city of Tapsus. History makes scant mention of this important town, but judging from the remains of the existing theatre and amphitheatre, and the archæological fragments that have been found here, *Rusicada* must have contained a large and wealthy population [Illustn. lii, 170, 173]. The town of Philippeville is built on the old site, and the *cavea* of the theatre was till recently the playground of a school, covering the site of the *proscenium* and its porticoes. Some three miles further west is the Roman port of *Stora.* The natural beauty of the spot, sheltered under the wooded hills, remains, but the constructional works have disappeared, excepting the walls of the old cisterns. Nor need we linger at *Igilgilis*, the modern Djidjelly, except to mention that some beautiful statues were unearthed here a few years ago. A few words will suffice for *Saldæ*, the modern Bougie. "Wonderful," says Leo Africanus in 1526, "is the architecture of its "houses, temples, colleges and palaces." Such was its prosperity in the tenth century that it received the title of "the little Mecca."[57] Destruction here has been well nigh complete. One Saracenic arch, the walls of great reservoirs, traces of the Roman *enceinte* and of an amphitheatre, are the sole remains of one of the chief commercial ports of the Mediterranean. The beauty of the scenery words would fail to depict. "Such is "the grandeur of the mountain scenery," says Campbell the poet, who visited Bougie in 1834, "that I drop my pen in despair of giving you any conception of it. Scotchman as "I am, and much as I love my native land, I declare to you that I felt as if I had never "before seen the full glory of mountain scenery."

Some few miles south-west of Bougie are the scattered remains of the ancient *Tubusuptus*, the modern Tiklat. The site is strewn with Roman stones. The walls of the great cisterns are still standing, consisting of 15 galleries, each being 116 feet by 13 feet 9 inches, and about 20 feet deep. The dividing walls are 2 feet 9 inches thick, built

[57] According to Marmol, Bougie contained at the end of the 10th century 20,000 buildings and 100,000 inhabitants.—A. G.

of rubble, but carefully constructed. These great reservoirs are a peculiar feature in North Africa, being found, some in a fairly perfect condition, on the outskirts, or frequently within the walls, of nearly every town. Those at Carthage, for instance, known as the smaller cisterns, to distinguish them from the larger series, which may be assigned to Punic times, are even now in good preservation, although built with small and irregular-shaped stones. The hardness of the mortar, here as elsewhere, is very noticeable; and the cement lining, known as "opus signinum," extremely thin, and made of crockery shards, is of so hard a texture as to be broken with great difficulty. The secret of mortar composition appears to have passed from the Romans to the Arabs, who still employ the same ingredients in the construction of arches, terraces and cisterns. The composition appears to be one part of sand, two of wood ashes, and three of lime. After being thoroughly incorporated, the mixture is beaten for three days and nights with wooden mallets, sprinkling a little water, and at times adding a small quantity of oil, till the whole becomes of due consistency. In the jointing of pipes also the Arabs follow the method of the Romans, beating together tow and lime with oil, and without water. The composition speedily assumes the hardness of stone, and is impervious to water.[58]

The whole subject of water provision by these energetic and thoughtful Romans has been a constant theme of admiration. It was the first consideration in the establishment of a colony. Marshal Randon, in his African expedition of 1837, said that whenever his regiments were suffering from want of water, he inquired of the natives if there were any Roman remains in the neighbourhood, and having sought them, never failed to find water there. No doubt the whole face of the country presented a very different appearance. Mountains were better wooded, and watercourses that now lie buried under the sand traversed the vast plains, a complete system of irrigation being established. Agriculture, which was regarded as a science even by the Carthagenians—for, says Columella, "we honour above all other writers Mago, the Carthagenian, the father of "husbandry"—was conducted by their successors on a far more extended scale. We know also that the fauna of the country has completely changed. Tingitane once provided elephants for the circus; and on rocks are to be seen rude representations of the giraffe, the rhinoceros and other animals that are now quite extinct.

We must reluctantly pass by *Icosium*, the modern city of Algiers. Nothing remains of Roman edifices, and the large number of antiquities relating to Roman occupation are either to be found in the different museums in Algeria, or have been removed to the galleries of the Louvre. We now arrive at one spot on the coast where we might linger for some time. It is the ancient *Jol,* afterwards ennobled as *Julia Cæsarea,* and designated by the Arabs as Cherchel. Before entering upon a description of its monumental remains, and endeavouring to picture the city as it existed in the first century, a few

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[58] The Romans appear to have been acquainted with the use of leaden pipes, although they had not the appliances for fabricating any of large dimensions, or sufficiently strong to withstand pressure from the fountainhead. In the museum at Cherchel is a piece of lead piping made by rolling a sheet of metal, turning the edges over, and then running molten lead along the joint.—A. G.

words about the man who built it, and whose memory still clings to the spot he made his own during a reign of nearly 50 years, may quicken our interest in the numerous memorials of its past splendour. We revert to the troublous times when Julius Cæsar visited his African colony, for the purpose of finally subduing the Pompeian faction. At that period Juba I. sat on the throne of both Eastern and Western Numidia; a man of great parts, and who had seen much of Roman warfare. In an evil hour, emboldened with the thought of crushing the invader, he joined the rival faction. The two armies met at Thapsus; Juba was defeated, and his forces were completely routed. Attended by one companion he fled to Zama, where he had left his household and all his treasures. The gates were closed against him by the terrified inhabitants; and so the poor king, with a broken heart, fled to the woods, and there perished by his own hand. Numidia thus fell into the hands of the Romans; and Sallust, being appointed Governor of the Province, passed many years of his life at *Cirta,* the capital, plundering the inhabitants without mercy, and collecting materials for his great history of the Jugurthine war. The next chapter opens in the streets of Rome, where Juba's infant son, a captive with other Numidians, is gracing the chariot-wheels of triumphant Cæsar. The incidents in the career of this little lad are very touching, lighting up with unusual lustre the closing pages of Numidian history. His marked intelligence and comely looks won the heart of Augustus, who committed him to the care of Octavia, the Emperor's sister and the discarded wife of the ill-fated Antony. Devoting himself to literature and the arts of peace, the young Juba became one of the most learned scholars of his time; and on arriving at manhood's estate, Augustus, wishing to reward him for many years of faithful service, reseated him on the throne of his ancestors, and bestowed on him the hand of Cleopatra Selene, the beautiful daughter of Mark Antony and his Egyptian queen. Caligula, however, desirous of extending the Roman dominion in Africa, made Numidia a Roman province, and transferred Juba's capital from *Cirta* to *Jol.* Here on this beautiful headland, washed by the waters of the Mediterranean, Juba II. built himself a city, and embellished it with magnificent works from Greece and Rome. Here, during a prosperous rule of nearly 50 years, he gathered around him all the celebrities of his time in art and literature, introducing into his kingdom elements of civilization unknown to the unruly tribes of North Africa. And here, some ten miles eastward, on the summit of a lonely mountain, he built, after the fashion of his time, a tomb of gigantic dimensions, which was to contain the ashes of himself, his queen and his dynasty. Had Juba II. lived in other times, his career would have entitled him to a far more conspicuous position; but the dazzling rule of the Cæsars, and the stirring events in other parts of the world at the commencement of the Christian era, cast into the shade the unobtrusive labours of so peaceful a monarch, affording but few materials for the historian. Such was his renown and favour that the Athenians raised a statue in his honour, and the tribes of the Desert worshipped him as a deity, "Et Juba, Mauris volentibus, deus est." Of all his numerous works fragments only remain. It is enough, perhaps, that Pliny, Strabo, Plutarch, and other less prolific writers, bear ample testimony to the value of his labours, quoting freely from his histories of Rome and Arabia, and his numerous treatises on various subjects.

His dynasty was short-lived. He left but one son and one daughter. The former, Pompey by name, took up arms against Cæsar, was defeated, brought to Rome, and died ignominiously. The daughter was none other than that Drusilla, the wife of Felix, Governor of Judæa, before whom Paul was arraigned. It might have been she who prompted her husband to say, "Go thy way for this time; when I have a convenient "season I will call for thee."

The ruins of *Jol*, "*splendidissima colonia Cæsarensis*," as it is described in one of the numerous inscriptions, are very extensive. Sacked by Firmus in the fourth century it was razed to the ground by the Vandals a century later. Under Barbarossa it regained something of its former splendour, but it was almost entirely overthrown by an earthquake in 1738. After such vicissitudes it is not surprising to find the remains in a fragmentary condition. "Nothing," says Shaw in 1730, "could have been better "contrived, either for strength or beauty, than the situation of this city. A strong wall "40 feet high, buttressed and winding nearly two miles along the shore, secured it from "all encroachments from the sea." The outlines of the amphitheatre, choked with some 12 feet of earth, may still be traced in the middle of a ploughed field. Nearly all the steps have disappeared, and the blocks of stone and marble with which it was constructed have been treated as a quarry for many centuries past. The great cisterns containing more than four million gallons of water are still used as reservoirs, and in connection with the same system of supply as the ancient city. The principal *Thermæ*, the façade of which was 300 feet long, are scarcely traceable in outline, though the masses of solid wall still standing give a fair idea of the magnitude of the edifice. There were at one time three other palatial baths, the remains of one of them being still visible by the sea-shore. The hippodrome which less than fifty years ago was in fair preservation, with its portico and columns of marble and granite, is now a mere undulation of the surface. The stones have been removed, and the débris of half a century has almost obliterated the outline. Still *Julia Cæsarea* remains to be unearthed. Wherever excavations have been made, architectural fragments [Illustn. li, 168, 169] have been discovered; columns of black diorite, shafts of white marble, busts and broken sculpture, many of them replicas of Greek statuary ordered by Juba for the adornment of his city. Some of these are still stored in the little museum at Cherchel, sufficient evidence not only of the splendour of Juba's capital, but of his appreciation of the work of Greek artists. Outside the city are the remains of the aqueduct, conveying the waters of the Djebel Chennoua, consisting of a triple series of arches, of which only eighteen now remain.

A few miles east of Cherchel on an eminence overlooking the sea are the scattered ruins of *Tipasa,* which still retains its ancient Roman name. This town was founded by Claudius, is mentioned by Ptolemy and is also in the Itinerary of Antonine. The principal remains cover a confined area, but the sculptured and moulded fragments that remain (many of which are carefully stored in the garden of M. Trémaux, to whom the site of the ancient town was conditionally conceded some years ago) show the same refinement of detail observable at *Julia Cæsarea.* It is probable that the same colony of artists worked in both towns. Among the most interesting objects are the ruins of a semi-

circular fountain of the Ionic Order. The enclosing wall and the tanks are still in existence, as well as portions of the fluted shafts of white marble. A restoration of this charming monument by a close observer is quite possible. No one can fail to notice two white marble sarcophagi, beautifully sculptured and almost perfect, belonging to early Christian times and not later than the seventh century.

There is little to detain us, from an architectural point of view, west of Cherchel. Indeed I am not aware of a single Roman building in the western portion of the province of *Mauritania Cæsarea* sufficiently preserved to enable us to attach a history to it, or even a precise date. I may be undervaluing the archæological information to be obtained from the numerous inscriptions throughout the province, but it would be beyond the limits of this Paper to enter upon a task which is not within the scope of our present enquiry. It must be remembered that Rome colonized from the east, and that each step westward, increasing the area to be ruled, and at the same time the already overburdened responsibilities of the central government at Carthage, rendered it advisable rather to protect what she had acquired, by the aid of forts and military posts, than to promote the growth of towns she might not be able to control. Again it must be borne in mind that the Vandals invaded North Africa from the west, destroying everything as they advanced, leaving no stone upon another, till, worn out perhaps by the monotony of the occupation, they took to ravaging the plains, and after an inglorious rule of nearly a century this wretched race seemed to be worked out, and we hear of them no more.[59] History affords very scant information about the towns in this western province. It is probable that, with the exception of the towns on the coast which the Romans inherited from the Carthagenians, they were mostly military stations. The absence of fragments of decoration such as are invariably met with in all public buildings of Roman origin, favours this assumption. *Pomeria,* for instance, so named by the Romans from the abundance of olives and figs, and the luxuriousness of its fruit trees, was probably one of these military towns, selected on account of its commanding position. The Vandals here again helped so efficiently to its destruction that its very name was lost for centuries, and happily brought to light once more by the discovery of an inscribed stone. What became of the site every one familiar with Moorish history knows well, and Tlemçen, rising on the ashes of *Pomeria,* became, in the twelfth and thirteenth centuries, one of the chief cities of the great Mohammedan power of the West, a rival of Granada, a seat of wealth and commerce, and a home of civilization, art and philosophy. Nor need we linger at Oran, the doubt as to its having been the *Quiza* or *Portus magnus* of the Romans not having yet been determined. Accident may some day enlighten us upon this and many other points connected with the Roman occupation of this Western province, but for the present we must be satisfied with the knowledge that it contained a considerable population, and that many of the towns were raised to *coloniæ.* Before leaving this province, I cannot help referring to the ancient quarries at Kleber, twenty miles east of Oran, whence the Romans obtained some of their most valuable kinds of "Marmor Numidicum."

"Longis Numidarum fulta columnis."—*Juv. Sat.* 282.

[59] The Berbers may be considered to be the remnant of the Vandals.—A. G.

Colonel Playfair, the present British Consul-General of Algeria and Tunisia, who visited the quarries in 1880, made a Special Report on the subject, which was published in the Blue Book of Consular Reports for 1881. He writes:—"I almost fear to say all "I wish on this subject lest I should be charged with exaggeration; but in sober truth, "during the two days I spent in examining the ground in every direction, I passed from "one marvel to another, and left in amazement at the magnificence of the treasure, which "has lain so long, I will not say concealed, but exposed to the most superficial gaze "there. The supply is practically unlimited, yielding a mass of breccia and marble of "most varied colours, from the creamy white and delicate rose to the deepest yellow and "red. The quarries are now in full work, and marbles ready for shipment at Oran can "be had, I believe, at the rate of 400 francs per cubic metre. As steamers frequently leave "this port for the United Kingdom laden with Alfa fibre, masters would gladly take this "marble as ballast at 10s. per ton." While on the subject of marble, I may refer to other Numidian quarries worked by the Romans. At Filfilla, near Philippeville, the products are equally varied, though the bulk is a pure white. There is a less known quarry lying between Cherchel and Tipasa, yielding a breccia, but of inferior quality. The Romans appear to have obtained their finest specimens from *Simittu*, a town I have already referred to as being on the border land of Numidia. The quarries are of great extent, and the marble of finest quality is endless in variety. Blocks of any size can be had, and transport is made easy now the Tunisian Railway is completed. The quarries are worked by a powerful Belgian Company, who have a depôt in Liege, but who contemplate establishing another in London for the sale of this beautiful material.[60]

Another building product of North Africa, the so-called Algerian onyx or alabaster, is obtained near Tlemçen. It is found in thin layers on the surface over a large area of country, deposited by the action of water, although never met with in blocks large enough as a substitute for marble. The amount is practically unlimited, but the proprietor only allows a certain quantity to be extracted annually, in order to keep up the price.

Turning our steps southward to the towns of the plains, or of the Tell, as it is more properly designated, being the strip of cultivated land extending from the shore as far as the northern slopes of the Aures, a distance varying from 80 to more than 100 miles inland, we see, from a glance at the map, where the Romans established themselves in greatest force. *Sitifis*, the capital of *Mauritania Sitifensis*, one of the most important towns in North Africa under the Romans, and likely, on account of its geographical position, and its being the junction of some of the principal roads in the colony, to prove equally so to its present rulers, has been the victim of consecutive misfortunes. Though terribly shaken by an earthquake, A.D. 419, it did not prevent the Vandals a few years

[60] The summit of the mountains near Kleber comprises an area of nearly 1500 acres. In the internal decoration of the English Church in Algiers marble has been freely used. There is a dado round the walls composed of alternate slabs of various kinds of marbles and breccias, framed with bands of *giallo antico* and *breccia dorata*, surmounted by a frieze of smaller tablets of rose-coloured marble. In the Nave and Baptistery these contain memorial inscriptions. Among them is one to Augustus Leopold Egg, R.A., who died in 1863.—A. G.

later from razing what was left of it. Then two centuries afterwards came the Arabs who destroyed the *enceinte* and, treating the town as a kind of quarry, erected another adapted to their own requirements. Under these circumstances we cannot look for much architecture. A few pieces of sculpture, some fragments of mosaic, and broken shafts innumerable, constitute the chief remains of the capital of a great and wealthy province. Twenty miles north-eastward in the direction of *Milevum,* and on the northern slope of a mountain, are the extensive ruins of the ancient *Cuiculum,* the modern Djemila, giving ample evidence of its splendour. The outline of the Forum can still be traced, and the substructure of a hexa-pseudo-peripteral temple is clearly defined. In front of it was a kind of Propylæum which appears to have been carried round the sides, and within which, judging from the pedestals, were placed statues of eminent personages. In the centre of the site are the remains of a peristyle temple of the Corinthian Order, dedicated to Victory, and connected by a wall with a triumphal arch dedicated to the glory of Cæsar, Marcus Aurelius, Severus, Antoninus, to Julia Domna, mother of the Emperor; and to the divine Severus, father of the Emperor Marcus Aurelius. Such is the tenour of the inscription. This arch, dedicated to Caracalla, was erected at the commencement of the third century, and is even now in excellent preservation [Illustn. li, 167]. The proportions altogether are agreeable, but the entablature is thin and the niches are somewhat confined. There are no traces of statues, but it is fair to assume that the niches were occupied. The material is limestone of a very fine hard quality. The columns are monoliths. The reason why the attic is dilapidated is that the last Bey of the province, as late as 1837, sent workmen to remove the arch, thinking from the appearance of the monument it was built of marble, but finding it to be of stone, the workmen desisted from further destruction. During some excavations in 1842, a silver medal of Julia Domna, with this arch as the reverse, was discovered here; and as recently as 1878 a beautiful statue in white marble, representing "Modesty," was unearthed from the site of the Forum. It is in excellent preservation, and may be seen in one of the galleries of the Palace at Constantine. There are also traces of a theatre, and the interesting remains of an early Christian basilica.

Milevum, or Mila, farther east, was one of four *coloniæ* grouped together, each bearing the title of *colonia,* but having a common magistracy, the others being *Cirta, Chullu* and *Rusicada,* now known as Constantine, Collo and Philippeville. It appears to have been destroyed in the 11th century, the Arab town having been built, as usual, with Roman stones. Fragments of walls and of a ruined fountain are the sole remains of the Roman occupation.

Turning southward on to the Roman road between *Sitifis* and *Cirta,* and twenty-five miles from the latter, is the village of Oued-Atmenia, so called after the little stream of that name that skirts it. One and a-half miles from the village some chance excavation in 1878 brought to light, at a depth of 5 to 7 feet below the surface, the remains of an extensive range of buildings with detached pavilions, and several enclosures. So perfect were the walls and the mosaic flooring that an architect, M. Martin, was deputed to make drawings of them. These were executed with the greatest care, and were exhibited in

the Algerian section of the Paris Exhibition of 1878, deservedly obtaining a gold medal. The proprietor of this splendid establishment has been recently identified with Pompeianus, Proconsul of Africa in the reign of Honorius, a man of fortune and a noted breeder of horses for the circus, his name and title being preserved on a stone found at *Calama*, and now in the Louvre. The inscription commemorates the building of an establishment "ad peregrinorum hospitalitatem," that the works were executed under the supervision of Valentinus the "curator reipublicæ," with the authority of the Proprætor, T. Hertius Crispinus, and under the administration of the Proconsul, Pompeianus, "viro "clarissimo amplissimoque." The remains are those of the Baths attached to the establishment, the whole having been the country seat of Pompeianus, whose official residence was at Carthage, as the seat of civil government. The arrangement of the Baths does not need any special description. The apartments were not large, but the fittings were of a sumptuous character; marble was freely used, and the upper parts of the walls were stuccoed, but the frescoes have perished. The jambs and plinths of the circular *cella* and large *atrium* were of grey marble, and the shafts of white marble of the Corinthian Order. The floors were covered with beautiful mosaic of rich and varied design, some of them representing the stables and racehorses of Pompeianus, and illustrating manners and customs in the fifth century [Illustns. liii, liv]. The position of the stables represented in mosaic has been ascertained at a distance of 130 yards from the baths.

The breeding and training of Numidian horses was much encouraged by the Emperors, perhaps in painful recognition of the wonderful exploits of the wild cavalry, unbridled and unsaddled, that more than once gave the victory to Hannibal during the second Punic war. To the Carthagenians, or rather to her Numidian mercenaries, Rome was indebted for all her knowledge of the horse and its rider; and the institution of various kinds of chariot races, not only in Rome but in every large town in the Empire, drew the attention of such men as Pompeianus to the pecuniary and other advantages of a breeding establishment. Some ten years ago an inscribed stone was unearthed at Rome bearing on this subject. It was deciphered by M. Renan, and was the subject of a Paper read by him in Rome, before the *Société des Inscriptions et Belles-Lettres*, in November 1878. It commemorates the victories in the Hippodrome at Rome, A.D. 115-124, of one Crescens, a Moor, aged 22: and how during a period of ten years he succeeded with four horses named *Circus, Acceptus, Delicatus* and *Cotynus*, in gaining prizes to the value of 1,556,346 sesterces. Crescens, the charioteer, was evidently the Archer of his day, running the horses of some great proprietor, like Pompeianus of Oued-Atmenia. Were it not for the date of the inscription one might be tempted to suggest that the mosaic representation and the inscription referred to the same person. We have in the former, one Cresconius as the chief charioteer, and we also have the horse *Delicatus* tethered by himself as a favoured animal. The mosaic in the *Calidarium* is divided into four parts, representing the horses and stables. In the first we have a pavilion surrounded by gates or barriers, then we have the stables and apartments for grooms and charioteers, the name of the proprietor being written over the central edifice; and below, in two divisions, six horses covered with horsecloths and attached to four separate mangers. *Altus*, unequalled for strength

and who can leap as high as the mountains, is tethered to the same manger as *Pullentianus,* the stallion; then we have *Delicatus,* the elegant one; and below are *Polydoxus,* the glorious one, who whether he wins or loses is still beloved, tethered with *Titas* the giant; and in the corner is *Scholasticus,* the learned one, apart and tethered by himself as a philosopher should be. In the doorway leading to the *Sudatorium* is this inscription, the meaning of which is enigmatical, "INCREDVLA VENILA BENEFICA." In this latter chamber is a mosaic in two compartments. In the upper one we have on one side three pavilions in bright colours [Illustn. liii], and on the other a lady sitting in a high-backed chair at the foot of a palm tree, having a fan in her right hand, and in front of her is a pet dog that a servant holds, at the same time protecting his mistress from the rays of the sun by an umbrella in his left hand. Above is written FILOSO FILOLOCVS, probably from *filum,* a thread, this part of the garden being reserved for the ladies as a place for sewing. In the lower compartment we have the representation of a park enclosed with a hedge and a fence supported by strong stakes. This is the SEPTEM VENATIONIS, as it is written, and there we have two hares giving chase to three gazelles. In the angles are circular basins in which are fish and aquatic plants, and in one corner are the words PECVARILOCVS, showing that Pompeianus, however much he loved horses and hunting, had tastes also for cattle and the general products of the soil. The mosaic on the floor of the *atrium* is divided into three compartments by a rich bordering of foliage; the central compartment comprising five divisions gives a view of the house, having several storeys and numerous windows. It has a large pavilion at the angle, and in the façade is a high tower, surmounted by a balcony or awning, designated as SALTVARII. JANVS [Illustn. liv, 177]. The roofs are covered with square red tiles in patterns, and chimneys or pipes appear above the roof line. There are indications also of chimneys above the parapet of the principal pavilion. In the lower divisions we see Pompeianus directing a stag-hunt, and the huntsmen—Cresconius, mounted on the horse Vernacel, Argentium, Cessonius and Neanbus—lances in hand and in full pursuit, preceded by the dogs *fidelis* and *castus,* and followed by the attendants Liber and Diaz, the latter from Iberia, but both having their mantles thrown back, Spanish fashion, over the left shoulder. The chase is over, the huntsmen are invited to repose, conjuring up visions of attendant houris clothed in gorgeous raiment. Such might have been the intention of the designer of the two end compartments of the floor of the atrium. These six Asiatic females, with bejewelled arms and necks, their mantles thrown back over the shoulder, their head-dresses all different, and each sitting on some fantastic animal, surrounded by spheres of decreasing size, await explanation.

We now approach *Cirta,* the chief city of Numidia, the capital of Syphax and Masinissa, of Micipsa, of Adherbal, and for a short time, as we have already seen, of Juba II. Strabo tells us that *Cirta,* or *Cirtha,* in Punic language *Cartha,* i.e. *Civitas,* was a magnificent city adorned with numerous palaces, and could furnish 10,000 horse and 20,000 foot soldiers. It attained the height of its prosperity in the peaceful days of Micipsa, just after the close of the third Punic war. At his invitation a colony of Greek artists was established here, and some few of the remains may be ascribed to that period. No ancient writer attempts any description of the buildings, and the few records

by Arab writers are not to be relied upon, as they were written long after the destruction of the ancient city. Perhaps Constantine, as it was renamed, A.D. 313, will vie with any city in the world for grandeur of situation, occupying the entire summit of a rocky plateau at a height of nearly 1000 feet above the bed of the river Roummel, which girts it on the north and east sides, leaving a connection with the mainland by an isthmus on the west side. If one may credit traditional history, *Cirta* has been besieged and conquered no less than eighty times. Of course the Vandals had a turn at it, but the place was too strong for them, and when Belisarius entered the city, a century afterwards, he found the walls and buildings still entire. To the Arabs and their perpetual feuds we owe the destruction of Roman works, and of the great bridge that spanned the Roummel at a height of nearly 400 feet. In the long line of Beys who had their headquarters at Constantine one only, who came into power in 1771, can be credited with any good or beneficent work. To him we are indebted for a reconstruction of El-Kantara, or the bridge, in 1793, which stood till 1857, when the pier of the top storey next the town gave way, with its two adjacent arches. As restoration was thought impossible, heavy artillery was brought to bear upon it, and the bridge was replaced by the present commonplace iron structure. Shaw, who saw the Roman bridge in 1740, says it was "indeed a "masterpiece of its kind, the gallery and the columns of the arches being adorned with "cornices and festoons, ox-heads and garlands. The keystones also of the arches are "charged with caducei and other figures." Bruce also visited it in 1765, and, judging from his drawing, it must have been then in a ruinous condition. On the south side the outlines of a bas-relief of a female figure and two elephants can still be traced. The elephant, we know, was the symbol of Numidia. On a coin of Cæsarea is the head of Africa covered with the skin of an elephant's head. The female, holding apparently a sheaf of corn, may be symbolical of Plenty, the whole country between *Cirta* and *Sitifis* being known as "the golden land." We may look in vain for any traces of the triumphal arch described by Shaw, and called by the Arabs "The Castle of the Giant;" and the remains of another triumphal arch, drawn by Delamare and Ravoisié nearly fifty years ago, are now nearly obliterated. Nor are there any traces of the two temples, the substructures of which and many of the shafts were also to be seen at that time. It is gratifying to know that the Roman cisterns within the citadel have been repaired, and are used as a reserve store in case of drought or siege. Small portions of the aqueduct of Justinian's time are still standing, spanning the valley on the other side of the Roummel. It is constructed with great blocks of limestone in regular courses and without mortar. The piers are stepped. The five existing arches, more than 60 feet high, form a dignified monument, and the effect of the entire work lower down the valley, where the arches would necessarily rise to a height of more than 100 feet, must have been very imposing.

Tomb construction in North Africa is a subject of itself, but I cannot pass by the ruins of a two-storeyed building under the precipitous cliff of Constantine, and known by the title of "The Tomb of the Silversmith." The edifice was 19 feet long and 10 feet wide, solidly built, and paved with mosaic. In the walls of the lower storey were niches,

one of them having received a sarcophagus, in which a perfect skeleton was found. On the front slab was a long Latin inscription relating to one Præcilius, a goldsmith of *Cirta*, who enjoyed a happy and prosperous life of more than 100 years. It runs thus:—
"Here silently I lie, describing my life in verse. I have enjoyed a good reputation and "the greatest of prosperity. Præcilius is my name, a native of Cirta, following the art "of a goldsmith. My honesty was extraordinary, and I always stuck to the truth. I "was courteous to every one, and never refused to sympathize with others. I was merry, "and always enjoyed pleasure with my dear friends. After the death of the virtuous "lady Valeria I found life different. As long as I could I passed an agreeable and a holy "life. I have becomingly celebrated 100 happy birthdays. But the last day came when "I must throw off this mortal coil. While I was alive I made preparation for my death. "Fortune, which has smiled on me, never deserted me one single instant. May she "accompany you through life, and may you arrive at the same state as myself. Here I "await you. Come!"

The tomb of Lollius, about sixteen miles north-west of *Cirta*, needs little notice. It is of cylindrical shape, 34 feet diameter and about 18 feet high, built of regular masonry in the reign of Hadrian. It was erected by M. Lollius, a distinguished Roman, as a memorial of five members of his family. Twelve miles south of *Cirta*, on the summit of a hill in the centre of a wild mountainous country, is the overthrown mass of a public monument, called by the Arabs *Es-Soumah*, signifying "a minaret," or, in a more extended sense, "a monument," having all the appearance at a distance of a minaret or tower. Whether it was raised to commemorate a great battle or as the memorial of some distinguished person is a matter of doubt. There are neither inscriptions nor clue to the purposes of the structure. The destruction is almost complete, due rather to an earthquake than to any act of wantonness. The blocks of limestone that strew the ground, and the fragments of shafts and mouldings, are quite sufficient to enable a careful investigator to make a reconstruction of this monument. Its condition is much the same as when, nearly fifty years ago, M. Ravoisié restored on paper this Doric structure, which may be assigned to the first century. Fragments of every moulding are still there, with the exception of the triglyphs; the only difficulties that M. Ravoisié appears to have met with were in the number of shafts and in the treatment of the crowning features of the monument. Portions of seven shafts having been discovered after diligent search, the assumption that there were eight is not unreasonable; and looking at M. Ravoisié's drawing I think we may admit that the solution of the problem, if not altogether satisfactory, is very commendable, and that we have in the *Es-Soumah* a monument possessing extreme simplicity and great dignity.

The extraordinary fertility and beauty of the country east of *Cirta* proved so attractive to the Romans, that we find, in a comparatively small area, a larger number of towns than in any other part of the colony. *Calama*, the modern Guelma, and *Tibilis*, better known by its Arabic name of Announa, must have been centres of refinement as well as of wealth, if we may judge from their monumental remains. The situation of *Calama*, on the main road from *Hippone* to *Cirta* (traces of which may still

be distinguished), its fertile soil, with forests of timber and abundance of marble and limestone, favoured its rise at an early period of the Roman occupation. The destruction of the town may be traced to a late period of the Empire. It appears that the inhabitants, wishing to strengthen their position at a time when divisions were frequent, built a citadel removed from the town, where they could take refuge. Treating the ancient city as a quarry, they built up the new walls and ramparts with stones indiscriminately, using friezes, pedestals, shafts and tombstones, as they came ready to hand. We have, however, some of the walls of the great *Thermæ* still standing, fragmentary only compared with what they were fifty years ago, when the outline could be clearly traced. The whole scale of the building shows that *Calama* must have been a wealthy and populous town. The theatre was beautifully placed on the gentle slope of a hill. The walls are standing, and the steps, though mostly covered with weeds and vegetation, are clearly traceable, and much in the same condition as when M. Raivosié's careful measurements enabled him to restore this beautiful structure. The marked division of the *auditorium* into ranges of seats should be noted. During the Roman Republic all parts of a theatre were accessible to the different classes of citizens, but under the Empire gradations were observed, the first rows being set apart for senators, then came the military officers, and behind them were seats for the younger members of illustrious families. Behind these were the common people. At a later period, when military government exercised almost despotic rule, seats were set apart for soldiers. Nearly 200 inscriptions relating to *Calama* throw considerable light on the history of its inhabitants. There is one recounting the gift of 400,000 sesterces by a lady of Calama, who had been appointed perpetual flamen, the money to be expended in the construction of a theatre. It is quite possible this was the very theatre referred to. Gifts and donations of this kind became, in the later times of the Empire, a great tax on the wealthy, and on the aspirants to civic honours. We know, from many sources, that the citizens of Rome and the provinces considered it an honour, almost an obligation, to adorn the splendour of their age and country. The munificence of Herodes Atticus, in the time of the Antonines, is still marked by the stadium at Athens. At Palmyra the colonnades that lined the streets were all built at the expense of a private citizen. Hiero, of Laodicea, expended more than half a million sterling in the adornment of his native city. To Secundus, Bordeaux was indebted for the great aqueduct, at a cost of £100,000 ; and if Pliny the younger is to be credited, he exceeded that sum from his private purse for the improvement of the town of Como. These benefactions show one of the characteristics of municipal life under the Empire. Fixed sums appear to have been paid into the municipal chests by magistrates, and other civil officers, either on appointment or preferment. But these obligations did not stop here, for we find that the gift of some public monument, or of a statue, or the cost of a theatrical representation for the amusement of the people, was always expected. At *Cirta,* for instance, we read that a citizen, on his appointment as ædile, besides paying to the town the regulation sum of 60,000 sesterces, made a gift of a bronze statue, with its tetrastyle chapel, two other statues, and a triumphal arch, and, in addition to a distribution of money to the poor, paid the entire expenses of seven days'

theatrical representations. At *Œa,* the modern Tripoli, we learn that a widow there celebrated the coming of age of her eldest son by a gift to the town of 50,000 sesterces. The author of this statement adds that the widow shortly afterwards took a second husband, and fearing that she might be called upon for another similar sum, had the ceremony performed quietly a long way from home. Trimalchio also, giving orders in his old age for an extravagant tomb, desired that the sculptures on the front should represent him as distributing money to the people: "For," said he to his architect, "have "I not given a public entertainment, and two deniers of gold to each guest? Represent "then the triclinia and the guests, and all the people dancing for joy."

The remains of *Tibilis* may be assigned to the commencement of the fourth century. There is, however, an inscription on an altar dedicated to Hercules under Antonine, and another to Faustina his wife, both being by inhabitants of the town. The ruins cover a large area now comparatively bare and treeless, but well supplied with water. The site is exceedingly picturesque, and the view from the plateau where the citadel formerly stood is very extensive. The monumental remains comprise a triumphal arch, a triumphal gateway of two arches, another monumental arch, and a Christian basilica. Traces of an *enceinte* connecting these buildings together are visible. The earlier arch is of beautiful hard limestone, but is a poor composition. The mouldings are thin, and the absence of an attic, or even the supposition that there ever was one, detract from the solidity and dignity it might otherwise have had. The two other arches are of later date, and are constructed of sandstone, a material that did not admit of fine workmanship.

South of *Calama,* and on the Roman road to the southern frontier, occupying one of the most beautiful spots in Algeria, are the remains of *Thubursicum Numidarum,* now known as Khamisa. Excavations on an extensive scale were commenced in 1876 under the direction of Professor Masqueray, clearly showing that the town was of considerable size. The outline of the Forum has been traced, as well as an amphitheatre. There are also the remains of a theatre of the best period of Roman work, a triumphal arch, and a Christian basilica, the walls of which have been constructed with irregular masonry—tombstones, pedestals and decorative fragments, having been used indiscriminately. The walls of numerous houses are still standing, testifying by their arrangement that the private dwelling of the Roman was the prototype of the more modern Moorish house, with a central court, and the family apartments grouped round it. A large number of statues have been found, some of which may be seen in the garden attached to the commandant's house at Souk-akras, a frontier town about twenty miles distant. *Khamisa,* I may say, remains to be unearthed, and offers a great field for antiquarian research. The towns of *Medaura* and *Tipasa,* now known as Mdaourouch and Tifesh, both lay on the same range of hills as *Thubursicum.* The former preserves its name as having been the birth-place of Apuleius, author of the allegory of "The Golden Ass." The latter, according to El-Bekri, the Arab writer, was a city of great extent. It was destroyed three times, and nothing now remains but the walls of the Roman citadel, altered and restored by the Byzantines in the sixth century.

Eastward of these towns, on reaching the plains that separate Algeria from Tunisian territory, are the remains of the old Roman posts that once marked the boundaries of Africa Provincia, so called, and the kingdom of Numidia; and southward, in the midst of a cultivated country, timbered with oak and olive, and well supplied with water, it is still possible to mark the sites of numerous villages. Inscriptions alone help to fix their position, and one only, Zana by name, the *Diana Veteranorum* of the Romans, can show the remains of any public structures. The triumphal arch here was not an important monument, and the remains of the gate of the Temple of Diana are insufficient to enable any one to give an opinion on the character of the structure.

It is in the cities south of the plains and on the slopes of the Aures where we find, not only the largest, but by far the best preserved remains of the Roman occupation. The history of these towns, by the aid of their monuments and their thousands of inscriptions, of *Lambœsis, Thamugas* and *Theveste,* may some day be written. The student in Roman architecture will find amongst the remains, only yet partly explored, a larger amount of material for his note-book than anywhere else out of Italy, besides acquiring from the well-preserved inscriptions a considerable insight into the civil life of the Romans during a period of about three centuries. *Lambœsis,* commonly known as Lambessa, appears to have been built early in the second century, having been selected as the seat of military government, Carthage being the centre of civil government. It owed its development and subsequent splendour to its being the head-quarters of the Camp of the Third Augustan Legion. In the time of Tiberius the army was divided into twenty-five legions, eight of which were in the Rhine Provinces, three in Spain, two in Egypt, four on the Euphrates, six on the borders of the Danube and the Adriatic, and two in Africa. The number of soldiers constituting a legion varied at different times, but we may assume it was not far short of 20,000 men in the Antonine period. A decree of Septimius Severus accorded to the soldiers of this African Legion the privilege of residing with their wives, and numerous inscriptions show that it had in its ranks sculptors, skilled architects, and experienced artificers. Their duties were not purely military, for we learn they were employed on public buildings, bridges and aqueducts, that they made a military road from *Lambœsis* to Carthage, and constructed all the forts and military posts commanding the passes of the Aurès. Outside the camp is a pedestal bearing an inscription addressed to the troops by Hadrian, thanking them for their zeal and services. There is also the restored tomb of T. Flavius Maximus, a prefect of this Third Legion, erected, as the inscription informs us, by the heirs of Julius Secundus, to whom the former had bequeathed the sum of 12,000 sesterces to defray the expenses of a suitable memorial. The town of *Lambœsis* covered an aare of about 1,500 acres. When visited by Peysonnel, in 1740, forty triumphal arches were noticeable, and fifteen were standing. At the present day there are two only, both dilapidated. The site of the Forum has been unearthed; many of the columns forming the colonnade have been placed in position, and a large octostyle temple on the west side, having a podium 12 feet high, is sufficiently defined to enable one to judge of the scale and proportions. There is also the Ionic tetrastyle temple dedicated to Æsculapius and Health, during the reign of M. Aurelius,

with an atrium in front of it 200 feet long, and a series of chapels on either side, approached by an arrangement of steps. Nine of these chapels can be traced, and on the mosaic pavement in the portico of the central temple one may read Bonvs. Intra. Melior. exi., an inscription equally appropriate to a Christian edifice. The remains of baths, of an aqueduct, of several houses belonging to the wealthy inhabitants, mouldings, innumerable decorative fragments, and nearly 2000 inscriptions, offer to the student a great field for research.

The principal ruin is that of a large structure called the Prætorium [Illustn. lvi], the headquarters of the Third Legion. The original base was much below the present level. The building, as it now exists, is of two storeys externally, but it probably had an attic in addition; internally it is one vast hall, the great shafts attached to the wall reminding one of the interior of some Norman Keep. It might have been divided into several floors and lighted from the inside. It is now used as a museum, but being roofless, the contents are likely to suffer much injury in course of time. The Prætorium was the central block of a great range of buildings forming the barracks of the Legion. The walls of a series of contiguous chambers are still standing, and judging from their dimensions, 24 feet by about 15 feet, these might have been the apartments of the officers. The ground all round is covered with a thick mass of concrete, extending to a considerable distance on one side of the Prætorium. This was probably the parade-ground. The roadways are clearly traceable, one in a north-east direction being in excellent preservation, the lines of the footway and the ruts formed by the chariot wheels being very distinct. About 200 yards south-east are the remains of the baths of the camp. They cover an area of more than half an acre, and had most of the apartments in duplicate. The walls were decorated with frescoes, but none are sufficiently preserved to enable one to judge of the designs; one of the *piscinæ*, 6 feet 6 inches deep, with its three steps, is almost perfect, the cement lining being as hard as stone. A beautiful mosaic [Illustn. lvii], now much injured, was found here during some excavations in 1864; and another, representing the four Seasons, may still be seen in the museum at Lambessa. A drawing of it is given in Duruy's *Histoire des Romains*, and another of a mosaic slab found near Constantine is shown in Illustn. lv.

It is to be regretted that the systematic exploration commenced some years ago has been stopped, and though enough has been done to give a fair idea of the extent of the ancient city, one knows but little of its later history. The last Imperial inscriptions appear to be of the reign of Valentinian I. and Valens, A.D. 364-367. The division of the Empire proved fatal to its progress. It has, in the present day, all the appearance of an abandoned city. It might have been sacked and overthrown by the Vandals, and restored afterwards by Justinian, and perhaps occupied by the Arabs, by whom it has always been known under the name Tazzout, but the destruction we witness to-day is by the hand of time, the alteration of the earth's surface, and the accumulated débris of fourteen centuries, rather than by the hand of man.

About fourteen miles east of *Lambæsis* are the remarkable ruins of another city, covering a much smaller area, but in other respects possessing more points of interest to

the architect than any other in Algeria. It is the city of *Thamugas, Tamugadas* in the Itinerary of Antonine, and Timegad of to-day. It has not inaptly been termed the Pompeii of North Africa. Like most towns in this country, *Thamugas* suffered from earthquakes, but like *Lambœsis,* its present condition is due rather to neglect and abandonment than to any other cause. It was never fortified in Roman times, as it was ill-adapted for defence, and it had no enclosing wall. It was evidently a city of delight; the fertility of the soil, the beauty of the mountain scenery and abundant water supply, attracting to it citizens of wealth from other parts of the colony. It was essentially a Roman city, a miniature of the great metropolis. In support of this assertion we have here, on imperishable limestone, the names of all the chief civil functionaries in the time of Valens, and as clear as when they were written. Every name is a Roman name. The attention of the French government was called many years ago to these remarkable ruins, resulting in an excellent report by Professor Masqueray, in 1875, followed by a partial exploration under the direction of architects attached to the *Service des Monuments historiques.* These gentlemen entered upon their duties full of zeal and enthusiasm, but forgetful of the burning sun and the miasma that surrounds unearthed detritus, were attacked with fever, and one of them died. The work, on the occasion of my visit in 1883, appeared to be stopped, but the results of the exploration were very gratifying, a large portion of the Forum having been unearthed, and the lines of the main streets brought to light. The town was built on a series of hills cut into broad terraces on the lower or northern slopes of the Aures. On the first hill was the Forum, with the theatre immediately behind it cut into the rock, lower down in a north-west direction being the triumphal Arch of Trajan. On a second hill, west of this, but separated from it by a ravine, was the great Temple of Jupiter Capitolinus. And on a third hill, south of the Forum, once covered with Roman buildings, was erected, at a later period, a great Byzantine fortress or citadel. The north façade of the Forum had a colonnade in its entire length, intersected by a gateway of a monumental character, having an Order larger than that of the colonnade. A flight of ten steps within this gateway formed the principal approach to the Forum, which measures 162 feet by 145 feet, entirely paved and surrounded by a broad colonnade of the Corinthian Order, raised two steps above the general area. On the east side was the basilica, and on the south the theatre, to which it probably had access, but as it is now buried in 16 feet of earth, it will be a long time before this side of the Forum is exposed. The upper part of the theatre is a complete ruin, but the lower ranges of seats are all visible. The wall of the podium of the *cavea* is traceable, and, what seems unusual in Roman theatres, there is a space between this wall forming a high balustrade, and the bottom range of seats. On the west side of the Forum was the *curia* or senate house, of which the substructure and part of the walls are standing. In front of the *curia,* and approached by a little staircase on one side, is a platform surrounded by a wall, and occupying the entire width of the façade. This was undoubtedly the "tribune," where the magistrates sat on the "sella curulis" when transacting public business, and which had so large a place in the public life of the Romans. The area of the Forum is covered with pedestals

and inscriptions, most of which are on hard blue limestone, and quite legible. The pedestals have been overthrown and misplaced, but it is probable that the entire Forum was lined with statues and dedicatory pedestals to the glory of the Emperors, or to perpetuate the good deeds of the citizens of *Thamugas.* The Temple of Jupiter Capitolinus was of large proportions, the dimensions being about 120 feet by 85 feet. It had a magnificent portico of the Corinthian Order, the shafts of which were about 50 feet high. Five of the columns and a portion of the entablature were standing in Bruce's time, but now the whole temple is a complete ruin, the drums of the great shafts lying on the ground like a heap of gigantic coins. There is an inscription on four stones, showing that this temple was restored in the reign of Valentinian I. In the axis of the Forum a wide road, traces of which are conspicuous, leads in a northerly direction, and at its end, near the apparent boundary of the town, was a monumental gate similar in scale and arrangement to the one forming the principal entrance to the Forum. East of the Forum, and on the other side of the basilica, appears to have been a smaller forum. This might have been the "Forum venale," the larger one being the "Forum civile." In a north-west direction, about 400 feet from the angle of the latter, is the ruined triumphal Arch of Trajan, now falling so rapidly to decay that in the course of another ten years it may cease to exist [Illustns. lviii, lix]. The mass of the monument is of sandstone, but the shafts and pedestals, the entablature and the crowning of the attic, are of white marble. The attic itself was probably faced with slabs of the same material. The architectural treatment is original. Over the side arches are square recesses, flanked by Corinthian columns supported on decorative corbels, and surmounted by a projecting entablature breaking all round. The principal cornice and the cornices of the segmental pediments over the side arches are broken in the same way, producing altogether a very rich effect. Both façades are similar, but the capitals vary in detail, quaint griffons and other fantastic animals being still visible on two of them on the east side. Many fragments of inscriptions, supposed to have formed the slabs of the attic, have been found, but not one of the series fits into the panel. The inscription of ten lines that M. Renier copied, as belonging to the arch, has now disappeared, and another in seven lines, stating that the arch is dedicated to all the gods, hence called the "Arch of the gods," does not adapt itself to the shape of the attic. The weak point of this monument is the lowness of the attic. In other respects the proportions are good, and the mouldings and decorative features of a high order. It appears to have been surrounded by statues and dedicatory pedestals, forming altogether a monumental group of which the citizens of *Thamugas* might well have been proud.

Standing amidst this scene of desolation, this wilderness of stone and marble, one is inclined to ask why such a city, with such an accumulation of treasures, should have been erected in this wild and treeless region, where nature presented so many difficulties to overcome, and gave so little encouragement to the cultivation of those gentler arts which must have flourished here for at least three centuries. You climb the hill above the Forum, and, sitting on the ruined wall of the old theatre, the problem is solved. Those ravines east and west, where the mountain waters unchecked rush wildly into the plain, were once water-conduits. You can see how they were confined by stone walls,

where they entered the cisterns, how they passed under the main streets, where, at their junction below the Forum hill, they supplied the great Baths, and then descending into the plain, contibuted, by a proper system of irrigation, to that fertility which, to the Roman husbandman, was only another word for abundance. You see the little Forum at your feet, with its pretty colonnade, its ranges of pedestals of stone and marble and alabaster, its statues, its inscriptions on imperishable blue limestone, its little tribune under the portico of the curia, covered with an awning. You see on your right where the Roman multitude thronged the basilica; on your left the portico of the great Temple of Jupiter, cutting the blue sky. Cast your eye a little lower down, and there is the beautiful arch with its attendant groups of pedestals and statuary, and the *Lambœsis* road winding gracefully through it up the hill side. Those mountain slopes are forests of oak and ash. Those spots on the hill side are cultivated gardens, the delight of the magnates of *Thamugas.* Beyond are the olive woods covering the spurs of the mountain. Below is the great plain, a sea of fruitful verdure or abundant grain, and further still, framing the whole picture, are the beautiful mountains, curve and peak vying with each other in grace of outline, receding and receding till the eye becomes dazed with gorgeous colouring and interminable distance. Surely *Thamugas* must have been a pleasant city fifteen hundred years ago.

We need not linger at *Mascula,* now known as Ain Khenchla. It was a garrison town, built at the commencement of the second century. Nothing of Roman work is left but the conduit, and there are traces of a theatre and a temple. It appears to have prospered in Christian times, for Christian ornaments are numerous, and the names of two bishops of *Mascula* have been preserved.

We now approach the last and most remote town in South Algeria, the *Theveste* of the Romans, modernized into Tebessa. Neither Sallust, nor Tacitus, nor Pliny, makes any mention of this city, its name appearing for the first time in the geography of Ptolemy. The oldest inscriptions are of the reign of Vespasian, but the town was of no importance till the close of the second century, when it became one of the richest and most populous in North Africa. Without entering into any detailed description of the remains, which not only cover the site, but are to be found scattered over many miles of country, we will direct our attention to the few monuments of special interest that are still standing. Thus the quadrifrontal arch of *Theveste* attracts considerable notice on account of the rarity of this form of monumental architecture [Illustns. lx, lxi]. It may compare favourably with the arch of Janus at Rome, but is in every way inferior to the similar great arch at Tripoli. From inscriptions we learn the entire history of this structure, how the youngest of three brothers, representatives of the family of Cornelia, left all his property to his two brothers on the condition of their erecting a triumphal arch in his native town, to be surmounted by two tetrastyles,[61] enclosing statues of the two Augusti. This Caius Cornelius Egrilianus, who commanded the Fourteenth Legion, Gemina, which was quartered in Pannonia, must have been a man of considerable substance, for he further enjoined his brothers to erect statues of the

[61] A tetrastyle is usually composed of four columns, forming a square on plan, and covered with a *tholus*

divine Severus and of the goddess Minerva, to appropriate a sum of 250,000 sesterces for the purpose of affording gratuitous baths to the inhabitants in the public *Thermæ*, and lastly 170 pounds weight of silver and fourteen pounds weight of gold were to be deposited in the Capitol for purposes that the much worn inscription here fails to inform us. This monument is commonly known as the Arch of Caracalla, the two Augusti referred to in the testament being Caracalla and his brother Geta. It appears to have been built just after the murder of Geta by his brother. The material of the arch is a very hard close-grained white limestone. The eastern façade has an inscription dedicatory to Septimius Severus, and on the keystone of the arch is the head of an emperor, probably Severus himself, enclosed in a medallion and resting on the head of a Medusa. On the frieze of the west façade is a dedication in honour of Julia Domna, wife of Septimius Severus, and mother of the Augusti. The head sculptured on the keystone of this arch, representing a young female surmounting an eagle on a thunderbolt, cannot be intended for the Empress, who at the time of the erection of this monument had passed middle age. It was probably a symbol of *Theveste*, then a young and rising city. The inscription on the south façade is illegible, and the northern side has been restored. These inscriptions were probably in honour of Caracalla and Geta. The peculiarities of this monument are, the unusual width of the frieze and the absence of an attic—two tetrastyles, so-called, being substituted for the latter as a crowning feature of the edifice. It has been suggested that there were four such tetrastyles, one to each façade, but there is no mention of such an arrangement on any inscription, nor is there any indication on the monument itself of there having been more than the two mentioned in the testament of Caius Cornelius Egrilianus. The little tetrastyle temple, erected about A.D. 300, dedicated either to Jupiter or Minerva, deserves more than passing notice, partly because, like the arch we have just been considering, it shows a departure from the recognized proportions and treatment of a classic Order. The material is of hard fine-grained limestone, the six columns forming the portico being of marble. There is no architrave, the decorative frieze is divided into panels, and the entablature and attic over have proportions and outlines totally at viarance with orthodox notions.

No remains in Algeria have attracted more attention than the ruined Basilica of *Theveste*. Built not later than the end of the first century, it appears to have been almost destroyed, with the city itself, during the incursions of the Moors and the wild tribes of the Aures in the sixth century. When Solomon, the successor of Belisarius, arrived at the gates of *Theveste*, he found the whole place in ruins ; and we learn

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or cupola. It was intended to contain a statue of bronze or marble. Here is an inscription found at Constantine :—

C. IVLIVS Q. F. QVIR POTITVS TETRASTY LVM. ET THOLVM D. E. D.	Caius Julius, son of Quiritus, of the tribe of Quirinus, surnamed Potitus, has given and dedicated a tetrastyle and a cupola.

—A. G.

have but little claim on our attention. It may be said that the triumphal arch, the glory of the Empire, symbol of power and of national progress, is a mere monument of the past, for triumphing Cæsar with his spoil-laden legions needs it no longer; of the great *Thermæ*, which in the later Empire became part of the national life, the club and the café for all classes of citizens, that their value departed with the people who originated them; of the aqueduct, that its stateliness has for ever given place to more prosaic forms. The basilica has been superseded by the Mart, the Exchange, the Court of Justice. Even the colonnade and the portico, which the Roman made his own, and which are still amongst the most beautiful of architectural forms, have had their day, though let us hope, to return again in the cycle of recurrent change. Granted that the fashion of all these things has passed away, we must admit that the spirit which prompted them is with us still. The growth of nations, the revolutions in public and social life during a period of fourteen centuries, have failed to dim the Roman name, or to break the spell of his compelling genius. His laws, his language, his literature, his festivals, even his calendar, keep their ground. And in architectural forms do not the Christian cathedrals, or even the simple village church with its nave and aisles, its arcaded lines and its apsidal choir, remind us daily of their Roman prototype, the basilica of the Cæsars? The student goes forth to realize the dream of his youth, the world of antiquity. He bends his steps towards Rome, not the Rome of the Popes, but the Rome of Imperial Cæsar, for therein lies the spirit of the Roman. The antiquary, in these far-off isles of Britain, unearths and brings to light a pavement of mosaic, a stretch of wall, a fragment of pottery, and the interest of a county is in a blaze—kindled by the spirit of the Roman. The traveller in a distant land is attracted by some chiselled stone lying neglected by the wayside. He marks its familiar letters, and forgetful of aught else, strives to decipher the time-worn sentences; for on him likewise the genius of Rome has laid a spell. The vital force in all that the Roman originated, or adapted to his own ends, has no parallel. His architectural forms and methods, which in his case were representative of great national characteristic unity of purpose, undeviating but resistlessly progressive, have been embodied more or less by other nations in every succeeding style. It is good for us, as citizens as well as architects, to ask ourselves how it is that the Roman achieved, where others coming after him have failed. It is good for us to think over these things, in a spirit of acknowledgment of a long score of indebtedness, and to be brought face to face with the buildings themselves in their mass, their majesty and their precision. Of the monuments which have come down to us, forming no inconsiderable portion of our heritage as a civilized race, it has been my endeavour to indicate, however imperfectly, that not the least interesting, nor the least instructive to true lovers and students of our art, are those which, after cruel vicissitudes, are yet to be seen in their own mutilated beauty on the wooded hillsides, in the fertile plains, and amidst the desert sands, of Northern Africa.

ALEX. GRAHAM.

PRINCIPAL CITIES AND TOWNS IN NORTH AFRICA IN THE AGE OF THE ANTONINES, A.D. 138-180.

Roman Name.	Modern Name.	Roman Name.	Modern Name.	Roman Name.	Modern Name.
Amœdara	Haïdra	*Leptis Magna*	Lebda	*Telepte*	Haouch·el·keima
Agbia	Hedja	*Lixus*	El Araïch	*Thœna*	Tina
Aquæ·Calidæ	Hammam·righa	*Mactar*	Mukther	*Theveste*	Tebessa
Arsenaria	Sidi·bou·ras	*Madauri*	Mdaourouch	*Thibica*	Henchir·bir·magra
Assuras	Zanfour	*Mascara*	Maaskera	*Thibursicum*	Teboursouk
Auzia	Aumale	*Mascula*	Aïn khenchla	*Thuburbo maj.*	Tbourba
Avitta	Bou·flis	*Maxula·Prates*	Hammam·el·lif	*Thuburbo min.*	Henchir·kasbat
Babba	Narouja	*Milevum*	Milah	*Thugga*	Dougga
Bida	Djema	*Neapolis*	Nabel	*Thysdrus*	El·djem
Bisica·Lucana	Testour	*Oea*	Tripoli	*Tibilis*	Announa
Bulla Regia	Bulla Regia	*Oppidum Novm.*	Aïn·khadra	*Tigava*	O Taghia
Cœsarea	Cherchel	*Pomaria*	Tlemçen	*Timici*	Ain·temouchent
Calama	Guelma	*Portus·Magnus*	Vieil arzeu	*Tingis*	Tangiers
Capsa	Gafsa	*Quiza*	(?)	*Tipasa, m.*	Tefsedt
Cartenna	Tenez	*Rusaddir*	Melilla	*Tipasa, n.*	Tefech
Carthago	Carthage	*Rusgunia*	(?)	*Tuburnica*	Henchir·tebournok
Choba	Ziama	*Rusicada*	Philippeville	*Tubursicum*	Khemissa
Cirta	Constantine	*Ruspina*	Monastir	*Tubusuptus*	Tiklat
Cuiculum	Djimila	*Rusucurru*	Dellys	*Tunes*	Tunis
Chullu	Collo	*Sabrata*	(?)	*Usulitanum*	Djeloula
Curubis	Kourba	*Saldæ*	Bougie	*Usilla*	? Inchilla
Cyrene	Grenna	*Scillium*	Kasrin	*Usinaza*	Saneg
Diana Vet:	Zana	*Seressita*	Henchir·oum·el·abouab	*Uthina*	Oudena
Equizetum	El Guéria	*Sicca·Veneria*	El kef	*Utica*	Bou·chater
Gigthis	Sidi·salem	*Siga*	Takebrit	*Vacca*	Béja
Gilva	Aghbal	*Simittu*	Chemtou	*Vallis*	Sidi·median
Hadrumetum	Sousa	*Sitifis*	Setif	*Verecunda*	Markouna
Hippo Regius	Bone	*Sufes*	Sbeitla	*Vina*	Henchir·el·maden
Icosium	Algiers	*Syr*	Lella·marnia	*Volubilis*	Sarhoun
Igilgili	Djidjelli	*Tacape*	Gabes	*Zarai*	Zaraïa
Iomnium	Tagzirt	*Tamalleni*	? Telmine	*Zarytus*	Bizerta
Kasturrensis	(?)	*Thagaste*	Souk·ahras	*Zilis*	Azilia
Lamasba	Henchir merouana	*Thamugas*	Timegad	*Zeugis*	Zaghouan
Lambœsis	Lambessa	*Thapsus*	Dimas	*Zuccabar*	? Affreville
Lares	El orbos	*Thignica*	Äin Tunga		

The Names underlined were *Coloniæ*, the rest were *Municipia*.

Alex Graham del.

166. MAP OF NORTH AFRICA IN THE

(SEE THE PRECEDING

BRITISH ARCHITECTS, VOL. I. NEW SERIES.

AFRICA ESPECIALLY ALGERIA. (1)

E OF THE ANTONINES, A.D. 138-180.

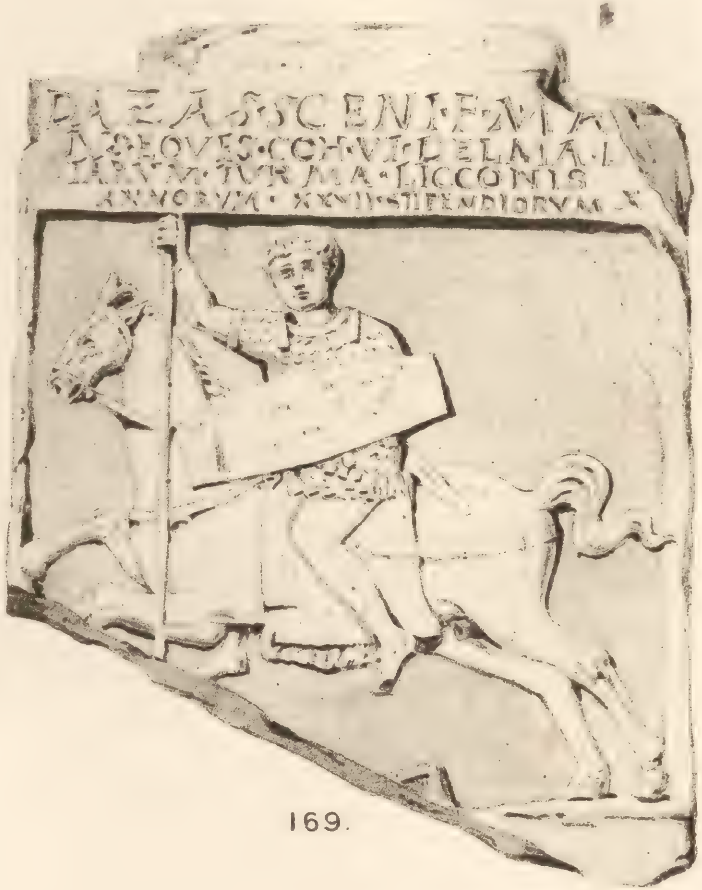
LE OF PRINCIPAL PLACES.)

IX. ROMAN OCCUPATION OF NORTH AFRICA ESPECIALLY ALGERIA. ii.

167.

ARCHIVOLT AND IMPOST FROM THE ARCH
AT CUICULUM.

168.



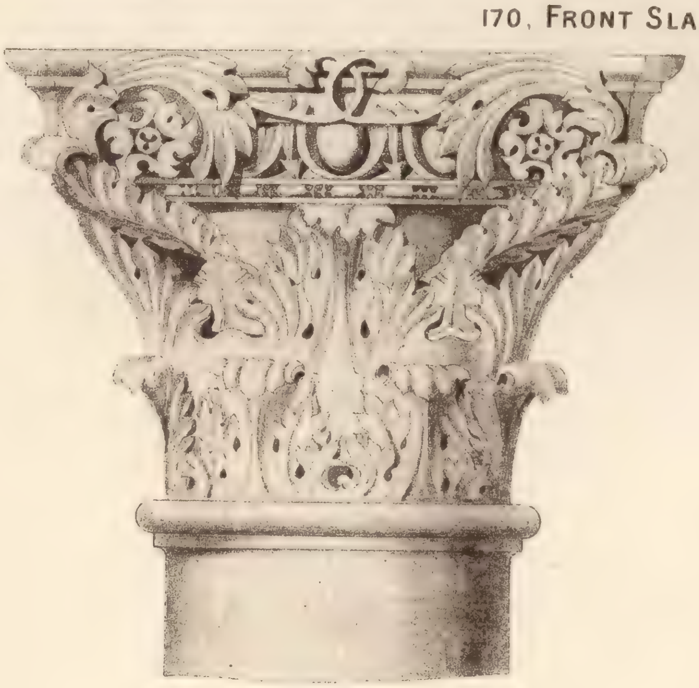
169.

TWO SCULPTURED MARBLE FRAGMENTS,
FROM JULIA CÆSAREA.

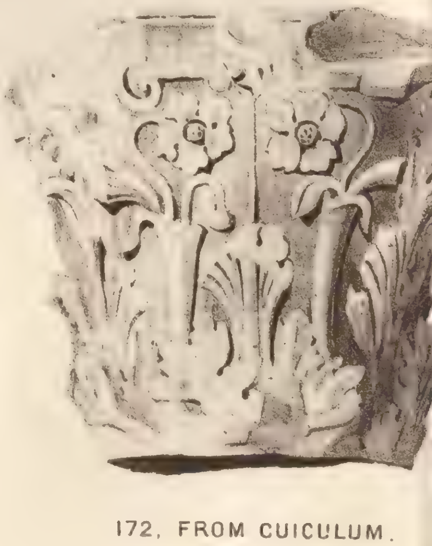
ALEX. GRAHAM, Del.

INK-PHOTO, SPRAGUE & Co LONDON

170, FRONT SLAB OF MARBLE CIPPUS, FROM THE



171, FROM ANNOUNA.



172, FROM CUICULUM.

FOUR CAPITALS O

ALEX: GRAHAM. DEL

MUSEUM AT PHILIPPEVILLE, ONE-SIXTH FULL SIZE.

173, FROM PHILIPPEVILLE.

174, FROM CHERCHEL

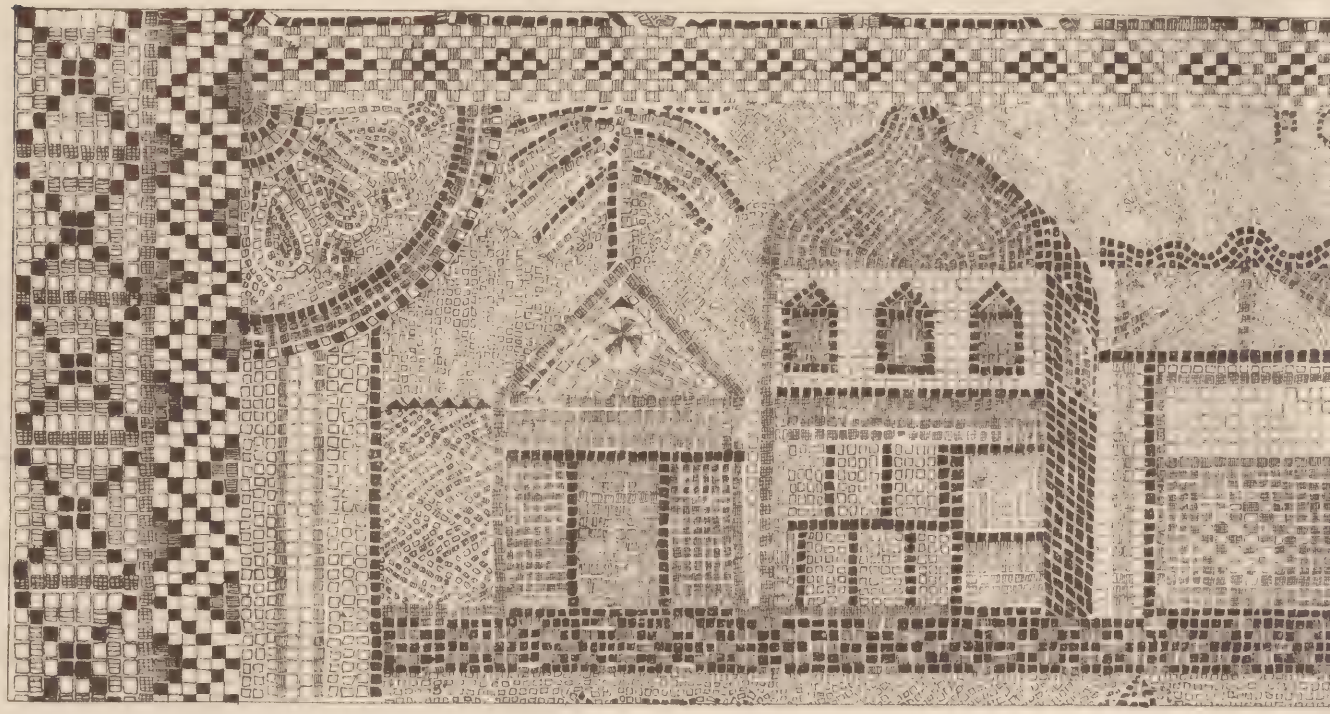
F LATE ROMAN WORK.

INK-PHOTO, SPRAGUE & Co LONDON.

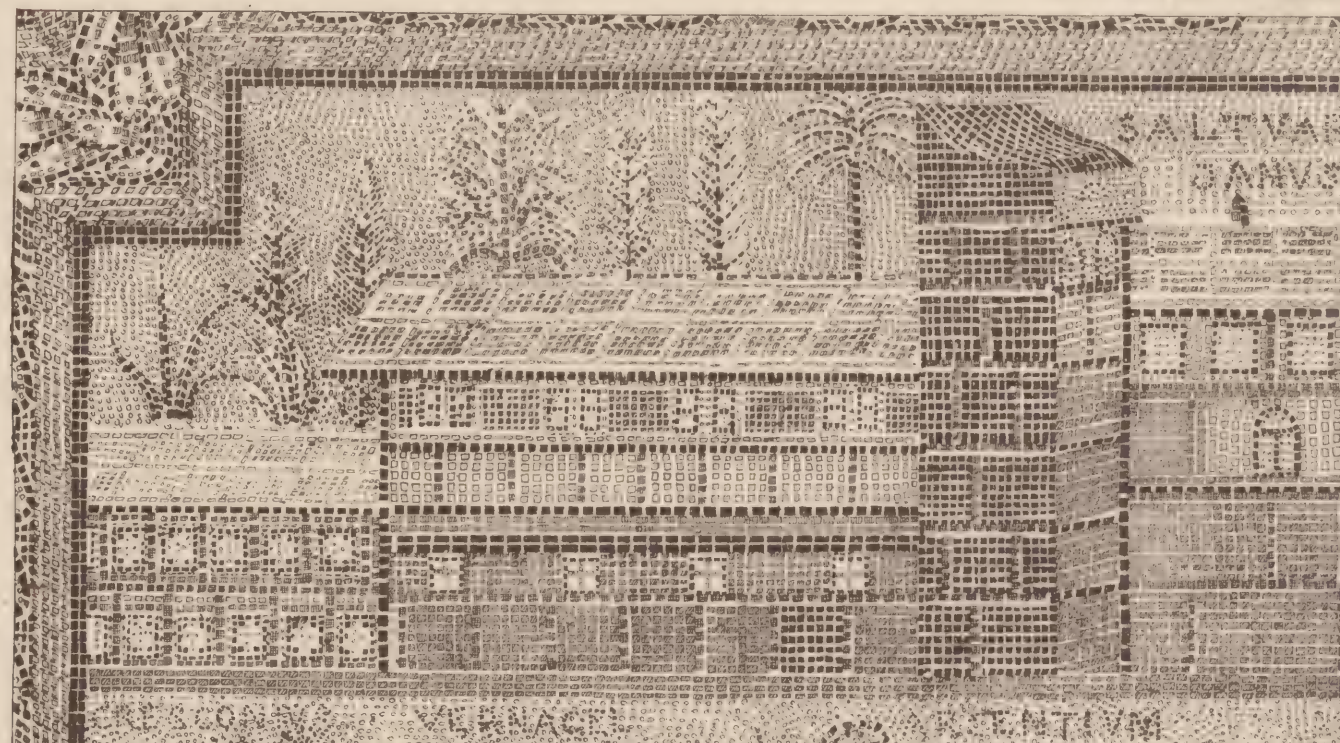
C F Kell Litho. Castle St Holborn, London, E.C.

175, PORTION OF MOSAIC FLOOR AT OUED-ATMENIA.

(Reduced from a coloured lithograph published by the Société Archéologique de Constantine.)

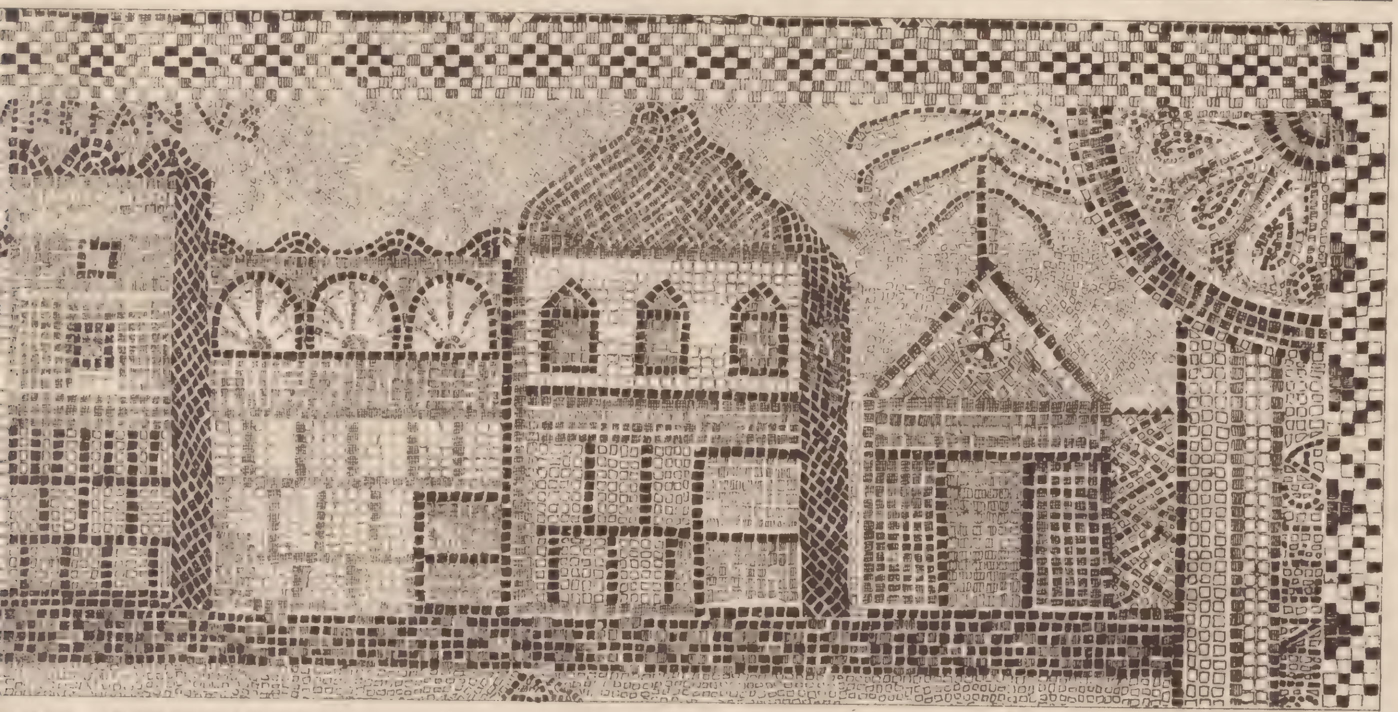


176. PORTION OF MOSA

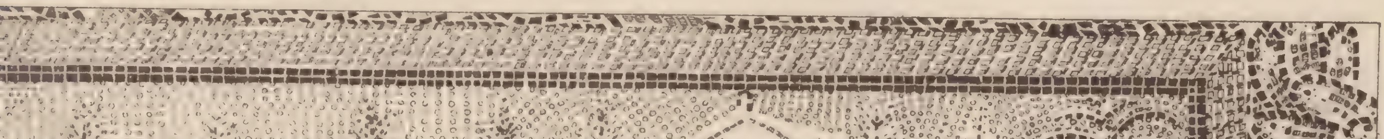


177. PORTION OF MOSAI

(Reduced from coloured lithographs publis



FLOOR AT OUED-ATMENIA.



C F Kell Litho. Castle St Holborn, London, E.C.

OOR AT OUED-ATMENIA.

y the Société Archéologique de Constantine)

Alex Graham del

C F Kell Photo-Lith Castle St Holborn, London E C

178. MOSAIC SLAB AT CONSTANTINE, ONE QUARTER FULL SIZE, (BYZANTINE PERIOD).

The Motto is composed of cubes of black and white Marble; the vases, flowers &c., are red, green and yellow, in shaded tints.

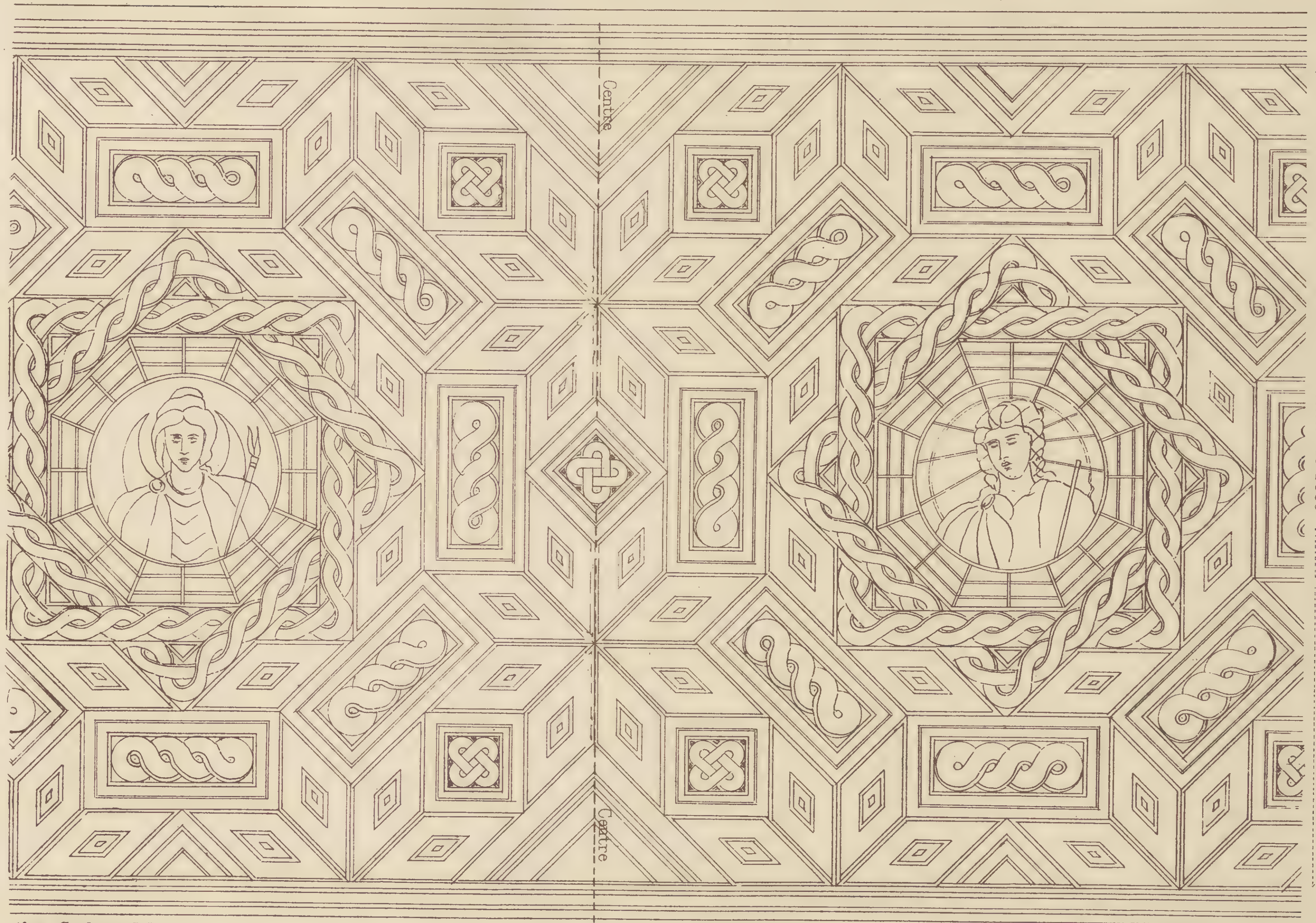
ALEX. GRAHAM, DEL.

179, REMAINS OF THE PRÆT

SKET

INK-PHOTO, SPRAGUE & Cº LONDON.

UM AT LAMBESSA (LAMBÆSIS),
IN 1883.



Alex. Graham del

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

180, PATTERN OF MOSAIC FLOOR AT LAMBESSA (LAMBÆSIS).

ALEX: GRAHAM, DEL.

181, REMAINS OF THE TRIUMPHA

SKETCH

"INK-PHOTO", SPRAGUE & Co. LONDON.

ARCH AT TIMEGAD (THAMUGAS,)
IN 1883.

182, PLAN.

183, RESTORATION OF THE TRIUMPHAL ARCH AT THAMUGAS.

ALEX: GRAHAM, DEL.

INK-PHOTO, SPRAGUE & Co LONDON

ALEX. GRAHAM, DEL.

185. REMAINS OF THE ARCH OF C
SKETCH

"INK-PHOTO". SPRAGUE & Cº. LONDON.

RACALLA AT TEBESSA (THEVESTE).
IN 1883.

ALEX: GRAHAM, DEL.

INK PHOTO. SPRAGUE & Cº LONDON.

186. RESTORATION OF THE ARCH OF CARACALLA AT THEVESTE.

IX. ROMAN OCCUPATION OF NORTH AFRICA ESPECIALLY ALGERIA. (lxii).

Alex. Graham del. F Kell Photo Lith 8 Castle St Holborn London E.C.

187. PATTERN OF MOSAIC FLOOR AT TEBESSA (THEVESTE).

Alex. Graham del

C. F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

188. PATTERN OF MOSAIC FLOOR AT TEBESSA (THEVESTE).

X.

PRESENTATION OF THE ROYAL GOLD MEDAL, 1885,

To Heinrich Schliemann, Hon. D.C.L., F.S.A., *Hon. Corr. Member* (Athens).

[Presented on Monday, 8th June 1885, Ewan Christian, *President*, in the Chair.]

THE PRESIDENT.—Dr. Schliemann, The Medal which I am to have the honour of presenting to you this evening is the highest distinction in the power of the Royal Institute of British Architects to bestow.

It is given by our Patron, The Queen, but Her Majesty entrusts to us the task, sometimes a very difficult one, of deciding, subject to The Queen's final approval, on the man most worthy to receive it.

I say that it is sometimes a difficult task, not from paucity of men, but rather the contrary, because this Institute, having always taken, as I think wisely, a Catholic view of its responsibility, has included within its scope of vision not only architects, archæologists and men of science at home, of whom there is no lack, but has also looked widely abroad, and invited the noblest and best amongst the learned men on the Continent of Europe to share with their brethren here, of like pursuits with themselves, the honour they so highly appreciate.

In the roll of Gold Medallists will be found the honoured names of men of Italy, of France, and of Germany—great architects, learned writers and archæologists; and we shall be proud to associate with that of the great Assyrian explorer, Austen Henry Layard, the now world-renowned name of Henry Schliemann.

In you, Sir, this Institute recognizes not only the indomitable explorer, but the earnest student of the arts of long past ages, one who, his youthful imagination having been fired by the grand story of the great poet of antiquity, has shown so powerfully that noble enthusiasm which "scorns delight and lives laborious days," that dogged pertinacity so delightful to all true Englishmen, which, having once fixed the mind on the performance of an arduous task, never wearies until it has been finally accomplished.

Few things that I have read of late years have interested me more keenly than the simple tale of early struggles in the pursuit of knowledge under difficulties, which you,

Sir, have given so freely to the world; a history of obstacles met only to be vanquished, of determination to learn, under all circumstances however disadvantageous, everything that could aid you in attaining what you have made the object of your life, the solution of the long-vexed question as to the existence and position of ancient Troy.

It is a story such as in these days of luxury and self-indulgence, deserves for the admonition of our youth, to be written in letters of gold; one that would teach them, if anything would, that success to be real, must be the product of resolute hard work, and that nothing is denied to well-directed labour.

That indefatigable industry such as yours, employed in the pursuits of commercial enterprize, should result in the acquisition of wealth is no uncommon thing; but that that wealth, so laboriously and honourably obtained, should without stint be freely expended on the realization of the early aspirations of enthusiastic youth, is a very rare and noble thing, and a most valuable lesson to all who are wise enough to ponder, or have the generosity to practise it.

I will not venture to detain you, Sir, or this Meeting, by speaking in detail of the great work you have been able to accomplish towards settling the controversy I have already alluded to, which has so long occupied the minds of many learned men, like yourself Homeric enthusiasts: a controversy resulting in conflicts almost as dire as those we read of between the Greeks and Trojans of old. Your labours in this direction, and in the discovery of the Homeric tombs at Mycenæ, with the wealth of gold and bronze ornaments which were then brought to light, and your exploration of the remains of the Treasury of Orchomenos, have added a new chapter to the artistic history of Greece, the full value of which has perhaps not even yet been realized by archæologists, but the importance of which can hardly be over-rated.

Of your labours at Tiryns, and the discovery, within the circuit of its well-known and long-celebrated Cyclopean walls, of the pre-historic Palace, possibly older than anything at Mycenæ or Troy, but still retaining its wall-paintings and decoration, we know enough to make us look forward with lively interest to the publication of your forthcoming work, which we cannot but believe will add to the fame you have already acquired, as one of the most liberal, undaunted and successful labourers in the investigation of the unrecorded history of the past, which this century has produced.

Sir, I congratulate you very truly and heartily on the success you have attained, and with all humility, and yet with pride, I rejoice to be the medium of presenting you with this Medal, the well-earned acknowledgment of the distinction you have so honourably acquired by your disinterested labours.

HEINRICH SCHLIEMANN, D.C.L., F.S.A., *Hon. Corr. Member*.—Mr. President and Gentlemen, I receive with profound gratitude the Royal Gold Medal you have presented to me. I am exceedingly proud of it—the more so as it is conferred upon me by Her Majesty the Queen, at the solicitation of this Institute, and more especially as this most distinguished body has already, more than eight years ago, elected me a Corresponding Member. I felt at the time when this high distinction was conferred on me, that it was

quite undeserved; but, nevertheless, I felt very much flattered by it, and have done ever since everything in my power to show myself worthy of the distinction. Not being able to accomplish this by any new inventions in modern architecture, which British genius has brought to the highest pitch of perfection and excellence, no better means occurred to me of showing my appreciation of it, than by using my pickaxe and my spade to make new discoveries in the architecture of the Heroic Age; and to solve the problems—the architectural problems—which had puzzled the wisest of the most skilful architects of all ages. I had in fact long felt that our knowledge of the pre-historic architecture was very insufficient and that it was most desirable that our ignorance should, as far as possible, be remedied. Our sole informant was Homer, whose poetic descriptions of the construction and the internal arrangement of the Heroic Palaces we do not even now understand. I venture to hope, however, that my discovery and excavation of the great pre-historic Palace of the ancient Kings of Tiryns, and of the galleries in its walls, with their eleven ogival chambers, and the three chambers we have lately discovered in the towers, will contribute greatly to explain to us the Homeric descriptions. Mr. President and Gentlemen, I beg you once more to receive the expression of my profound gratitude.

[Note by James Fergusson, C.I.E., D.C.L., LL.D., F.R.S., *Past Vice-President.*]

In the very first extensive exploration Dr. Schliemann undertook, he was fortunate enough to settle a controversy which had occupied the minds of some of the best scholars in Europe from the very beginning of this century. The dispute whether the ancient city of Troy occupied the heights above Bounarbashi, or was represented by the mound of Hissarlik, had divided Homeric enthusiasts into two hostile camps, and till his explorations there seemed no means by which a reasonable permanent peace could be arrived at, between the heated disputants. By an appeal to the spade he ascertained that no ancient city ever existed on the first-named site; while, on the contrary, he proved that the mound at Hissarlik did cover the remains of a city which certainly was at least as old as the Homeric Troy, and exhibited features which might reasonably be taken to represent those described in the legendary accounts of the poetic books of the Iliad. His next discovery of the Homeric tombs at Mycenæ was a curious complement and confirmation of his researches at Troy. The wealth of gold and bronze ornaments which were then brought to light was not only of a class quite unknown hitherto, but, from their age, of singular interest. The negative evidence alone was in itself sufficient to prove their being prehistoric. No trace of letters, or of writing of any sort; no coins; and what is even of more significance, no trace of even the rust of iron was found. These, combined with the curious early forms of their construction, are sufficient to prove that they belonged to an age at least as early as the Trojan war, and probably coëval with, or even earlier than, the heroes whose remains they were reputed to contain. The celebrated Treasury of Orchomenos, whose remains he explored almost simultaneously, tells the same tale, and serves to complete

the illustrations of a lost and forgotten art, which he has done so much to recover. He has thus "added a new chapter to the artistic history of Greece, the full value of which "has perhaps not yet been realized by archæologists, but the importance of which can "hardly be over-rated."[62] His crowning discovery, however, is that of the pre-historic palace at Tiryns, which is certainly older than anything found at Mycenæ or Troy, and may be centuries earlier than even the earliest date ascribed to the Trojan war. The old Cyclopean walls of that city were long well known to antiquaries, and had been celebrated from the time of Homer—who alludes to them—to that of the latest tourist in the Peloponnesus; but no one suspected, till Dr. Schliemann undertook his excavations, that within their circuit there still existed the remains of a palace co-temporary with these walls, still sufficiently complete for its plan and all its arrangements to be made out with a wonderful degree of completeness, and even its wall paintings and decorations be traced and restored with a certainty and distinctness unknown in any building existing in Greece at their age, nor found anywhere of that early age, except in Egypt. We are still awaiting the publication of the volume which is to contain an account of these most remarkable discoveries at Tiryns, which will no doubt add considerably to the fame Dr. Schliemann has already acquired from the numerous successful explorations he has carried out, and entirely at his own expense. Though his expenditure on them has been most lavish, and hardly equalled by any private individual in recent times, the credit due for this liberality has been surpassed by the important results which have been obtained, both to archæology and art, from the judicious and energetic mode in which his explorations have been conducted.

JAS. FERGUSSON.

[62] See the President's Address, page 158 *ante*, and also the letter of the Secretaries, addressed by order of the Council to The Queen's Private Secretary, General the Right Hon. Sir H. F. Ponsonby, in the Journal of PROCEEDINGS, 1884-85, page 179.

XI.

PROFESSIONAL LESSONS FROM A BOULDER: A PLEA FOR GEOLOGY AS PART OF AN ARCHITECT'S EDUCATION.

By Thomas M. Rickman, F.S.A., *Associate.*

[Read on Monday, 8th June 1885, Ewan Christian, *President,* in the Chair.]

AT the northern extremity of Cardigan Bay, near the old castle of Criccieth, half a mile to the west, on the shore, just above ordinary high water mark, you will find a large stone, some time since broken in two, the smaller portion lying flat, the larger part pyramidal-shaped, standing in the shingle beach and some nine or ten feet high; besides being split, it has been roughly shaped, has been weathered, coloured by the salt and spray, the lichen, the moss and the sea birds.[63]

You may sketch it first with the low sloping shingle beyond it, receding to the water's edge and backed by the hills, which run from Snowdonia to Cader-Idris, and, when you have been absorbed in its study you shall find the light upon it altered, the sea nearer, the twilight upon you, and the cooler air of a summer evening carrying you back in thought to the long time ago when that rock was made and wrought.

You shall take another view of that boulder in an opposite direction, seating yourself upon the stones nearer the water's edge, and have for background the clay cliff overgrown with vegetation, with its spring halfway up, the resort of the neighbouring cottagers, until driven from your seat by the advancing tide, you leave it with the impression of solitude, and the sense of the continuity of time and its unaltering ceaselessness of change.

And then again you get close to it, to note its scars and marks and colours, and, like the features of a well known face, you lose the recollection of its history and change, and becoming intent only upon its skin character, you find the variety of its colours growing upon you and its size apparently increasing, until the reflected light brightens its more weatherworn aspect. It grows upon you in apparent size and every inch seems the subject of a study, and you bring away your sketch with deep regret, leaving it to the

[63] See Illustn. lxiv, 189-192.

microscope and the photographic lens to lay bare its constituents, and to map out its surface among the forms of action and of life by which possession of it is claimed.

But, by this time, you will have walked round it many times to make acquaintance with its form, its projections, its recesses, its angles and its lines, until it seems to possess features and a personality. It is there to tell you many things, for all form is history if you will but read it; and some day we may hope to find some one to tell us that colour also is history had we but eyes to see the inside of its varied tints.

This much of its history its present condition tells us. It was deposited rock, it was covered up, it was reft and cemented together, it was metamorphosed, it was raised, it was exposed, it was broken off, it was carried, it was ground, it was dropped and then buried, it was exposed again, it was weathered and covered with nature's handiwork, it was broken by the hands of man, and it is passed by most of those who see it without a thought of its history or of its beauty, even though used by passers-by as a shelter from the storm.

We know that it was deposited rock because it is stratified; we learn that it was built up of particles of sand by its coarse texture; we see that among the sand was deposited an occasional lump, which we take to have been clay from its fine texture and different colour. As its composition appears even throughout, we conclude that it was deposited at some depth under water, and from the great thickness known to be attained by such rocks and its hardness, we also conclude that it was buried at one time under a great weight of superincumbent rock.

Like other rocks, it was split across, and these fissures were filled up by a white hard substance. The fissuring affected the sand and the clay in different modes, the sandstone was split straight through, the clay patches were split through with little ramifying fissures, intimating that these patches were in a different state from, and more plastic than, the other material. The white material deposited in these veins, which we take to have increased in bulk with the expansion of the cracks, has crystallized across the opening, as we see from its weathering at exposed corners. The stains from these points also tell us of something beside silex that was deposited in these veins.

The whole material was altered in texture as if by pressure, or heat, or long continued action. The clay became hard and black and dense; the sandstone became of a more glassy nature, and now it has been split, not like a bedded stone, which retains its fine distinctions of material in all its beds, but stepped irregularly, as the breaking force found now a part of one bed, now of another, as its easiest vent through the grey grit.

This rock was originally laid down at the bottom of the sea; the boulder has come down from Snowdonia to the sea level; at one time therefore it had been raised. How far the change in texture of the material, was effected at the same time as the deposit of its veins, or its hardening, or its elevation, or how these processes influenced one another, this stray morsel from an ancient horizon may not tell us, but it sends us enquiring to the ancient rock, where the origin of its material, the depth of its native water, the centre of its rifting force and the source of its infiltered veins may form the object of our study.

Then, in its story follows that long time after the heat, till cold attacked it; after

the rising forces from below had left it, till the wasting effect of subaërial denudation attacked it from above, during which period the mountains that had been made were shaped.

That long time was occupied at first by the continuous increase of the deposit of material laid upon the original sea-bed, its weight tending to generate those forces which wrought the change in its structure; and thereafter we can only speak of lapse of time, not of time that can be measured, till when those rays of light and heat, once so active, though for so long shut out, again were brought to bear upon the substance of the rock. It was those rays of light and heat, ever working through that long period, which had raised the vapour, had drawn the wind, had piled up the snow, and lastly formed the *névé* and the glacier. This course went on for periods we cannot name, and after that came the once more measurable time, during which the glacier, returning through its weight to its element, the sea, ground through all opposing obstacles and removed bit by bit the mountain capping.

How can the time be reckoned from when the sunlight was shut out from through the water till when those rays of light and heat illumined by a dull icelight the long enshrouded mass? Such length of time must be dwelt upon if we would read the story which the outline of every hill can tell us, such long time elapsed between the making of the stone and the commencement of the shaping of its outward form.

But it was exposed by the continuous movement of an irresistible force; the passage of a great ice sheet over it and past it and exposure evermore to the weather found out some hidden weakness of bed or joint, and after sustaining the slowly moving pressure, itself began to move, and the time occupied by a few generations of men would suffice to bring it from its hidden eyrie along the moving ice-stream, till its capacity for heat absorption and its ever acting weight caused it to be left with other débris among the glacial clay. Alternately an anvil and a file it earned its travel marks, and became the glaciated boulder, and was dropped by the ice foot somewhere near its present abode. As the ice above it lost hold, it lay among the comminuted fragments which had been its companions.

Its rounded subangular form tells the story of its journey, the clay bed adjoining shows its resting place; the lower half of the cliff is dense blue clay with stones of many shapes lying all ways throughout its mass, unsorted droppings. The upper part of the same cliff, sorted into sand and gravel laid in layers, tells us that moving water once again had sway, while the boulder lay sealed up, as in a grave.

The surface water shaped the area of which the remaining part now forms the fields above the cliff; these once extended further, and antiquaries tell us of a large district once inhabited, now part of Cardigan Bay. The south-west winds brought the sea from the Atlantic against it, and year by year the land gave way, the clay was washed out, the boulders were deposited on the shore, were rolled and played with by the waves, now resting on a bank, now undermined and carried out to sea, then reduced to pebbles and laid among a shelf of shingle. Thus was our boulder again uncovered and on the foreshore still holds its own. Pyramidal, rounded and scarred, it stood the biggest lump

along a mile of coast. Then grew upon it the rounded patches of lichen, black and white, and as they made a feeble soil upon its surface, after came the yellow, and began to exfoliate upon it, as if in imitation of the beds long since obliterated from its substance; after that came moss, and covered part of its surface with a blue green hairy fur, and the water and the shingle washed off some of these vegetable colours, and the salt water and the rain attacked the seams across its face, and found therein what they could dissolve, and so they pencilled lines of stain across its face, and the patches once of clay stood out black against the whitening weathered skin, and the birds made it their resting place and left their markings.

Then came the hand of man, who bored it, and with a blast of powder rent the mass in two; what his object was I know not; if he sought more convenient material for building, he left it unused, though he had obtained what might have done for a capstone to a dolmen. If he sought gold in its recesses he went away unenriched, nor did he completely expose the shattered face; fragments of moss upon the once-joined faces show that there was a time when the two pieces stood up nearly together, while the fur grew from each side till they nearly met, and almost repeated in vegetable life the story of the formation of the quartz veins through the mineral substance of the stone. Then came some night of hurricane and storm, when the tangle and the wrack were washed away, the shingle which had banked it up was passed on upon its continuous journey, and the slab which had been separated from the mass fell upon the ground, exposing to the view the once-folded pages printed in Nature's clearest type.

Such is the story of my friend the boulder whom I wish to introduce to your acquaintance. It is told by the form and the surface of the stone. Its individuality has arisen but late in its history. Is it the work of design? or will you call it the result of accident?

The deposition of the sand and clay at the bottom of the ancient sea was the effect of gravity, was the means of getting rid of material ground by other forces from the surface of the land. The hardening of the stone came from the changing position of the heat of the earth's crust. Its rising to the mountain top was an incident in the construction of the mountain chain. Its exposure and journey happened from the glaciation of the district. Its burial in the clay and its disinterment came from the slow changes of our present surface. Its fracture was a piece of wanton mischief, or the result of chance selection by the mason. Its botanical covering is the result of the universal presence of vegetable life seeking suitable soil to cling to. Its surface colours are due to sun and air, to sea and rain. Its shape conveys its history, and is the result of the actions it has been subjected to, and while its chiselling has required all the effects of all these actions, itself is but a page printed in a text patent to the eye of each observer who brings to bear upon it the necessary modicum of experience.

All these are marks of intention; but can we say that it was intended to make that boulder? The original bedding of the rock stands now almost vertical. If the stone has a flat base it is buried, and the shape of the mass has decided its present adjustment of position.

If it was torn from its native bed and raised to a lofty position it was by forces whose bent was to rend it asunder and its coherency kept the mass together till it should be the survivor of many fragments. The ice sought to cover it, but it was the cause of its being uncovered: it sought to shear it and to polish it, but its structure and shape resisted such action except on one or two faces. The sea sought to hurl it down and draw it into its depths, but the adjoining material only has been washed away. The boulder may be doomed, but it still stands. The force which first rent it produced the white grained silex which more closely cemented it. The lichens which would have covered it had only vegetated on a portion of its surface when the moss grew over them. The quarryman found it unsuitable for his purpose and it was left. Are these not marks of failure of intention, rather than of the result of design?

But the forces which have been mentioned had no intention; they obeyed the law of their being as did the materials of which the boulder was composed. And so the behaviour of the materials and the actions of material forces tell the truth.

You will say I have been a long time in describing my friend the boulder, and in coming to the lessons to be learned from it, but the lessons are not direct ones to which I wish to call attention, but indirect and contingent. Perhaps the first lesson I have brought you to is this of the truth of history to be learned from the behaviour of materials.

The next I would call attention to is the pleasure to be derived from spelling out a story, and the necessity of doing this with patience before criticising any work before you, be it of design, of art-workmanship, of imitation or of imagination; you must first put yourself in the place of the artist, of the artificer, or of whomsoever the doer may be; you must first learn whatever he has to tell you, and then you may come to his purpose, to what he was being made to do, why, and how he did it.

The study of a building combines all there is to be found in a boulder and much more. The study of most buildings leads one to suspect many of the facts presented to our eyes. The study of an ancient building is a relief to the mind because much that time could destroy has gone, and that part only which has most of truth about it is left, and it is that part which reveals the more genuine purpose of the designer. To those who are sick of looking at buildings old and new, the study of a boulder is a great relief. As a relief I would commend it to the architect, assuring him that he will find many of the questions relating to construction simple after he has tried to deal with the history of a hill side, a rock face, or a rolled pebble. He will find in it the alphabet of his art. He will see that shapes have meanings like the history of words, and he will be taught to put them together as sentences, containing something worth knowing, and not as nonsense verses, whose aim is but to imitate the sound of meaning, and while avoiding apparent false quantities, are apt to convey, by false allocation of words, a meaning either too unseemly for society to admit, or the perverse presentation of an idea which the general want of meaning shows to be far beyond the mind of the writer.

Now let us compare some of the questions which would be put to a stone, with the

questions which would be put to a building. Of a stone, you would ask, what is the nature of the material? Is it sandstone or limestone, a slate, a granite, or is it metamorphic?

Of a building, you would ask, is it designed for stone or for wood? Is its material construction well considered, the result of experience here and elsewhere, or original? Or is the style of it indigenous, but overpowered by the superior art of a race, with a stronger element of design?

Of a stone we would ask whence it came? Is it native deposited rock or intrusive? Is it a rolled pebble or a conglomerate?

Of a building we would ask, Is the style native? its materials do they fall into their places according to their nature, or is the art that which assumed its present form under far distant influences, though beautiful in itself, out of place? Or, are what we are looking at details which belong to a style natural elsewhere but wrenched and transposed and worn to a form unsuitable for their native positions? Or again, have we a style made up of such details brought into contact by outward force united by some extraneous bond?

In the stone we can find answers to the questions, and few stones are there which cannot give a reply, but in a building few are the cases where we can clearly separate the essential correspondent distinctions.

If we have learned to get answers from stones we can better hope to get replies from a building.

Of a stone we can ask, What does its form mean? What story does its form tell? Why do beds run through it? Why does the same angle recur on its exposed corners? Why is its major axis horizontal or vertical? We may get a reply that it is a piece broken off a larger rock, or that it was some great crystal-shaped morsel complete in itself, that it was rolled until it found a position of equilibrium, stable or unstable.

Of a building the same questions will ascertain for us that it was built like all the structures of that time and place, that such and such portions are left of a manifest original. Or we may learn from its diversity from the ordinary run, that it was erected from a special design, that it is a curious and original work of art; we learn also whether the building is still employed for its original purposes, and if so, what are the suitabilities for its use which have given it a long life, or what accidental circumstance in its nature retains it as a useful structure.

Then on closer examination, we would ask of a stone what are the remains of life embedded in it? Are they bones of animals, or wings of beetles, or stems of trees, that have grown elsewhere and died and been buried, or shells of molluscs that died there, or are they corals which themselves helped to build the stone? Are they fossils or pseudomorphs?

And of a building we would ask, of its mouldings and details and of the shape of the stones, Are they made as if the makers knew how? Have they individuality? Were the parts shaped to maintain others by sheer strength, or to carry forward strains? Or was apparent exuberant growth a design implanted? Or is the art that of the workman? Or is the wall a native action of the sea? The materials, are they stones cut with a purpose, and so answering to fossils? Or are they cast in a mould, and so but pseudomorphs?

In the Natural History Museum, first floor, large right-hand gallery, are cases of these curious things—pseudomorphs, where life has been extinct, where the crystal has wasted away, and other material has taken their places and obtained a form, naturally obtained from action, but in these cases obtained from the filling up of a mould. Bricks, that can be cut, and have been so treated, may receive our respect, clay that has been worked with a tool before burning also, but in this sense, hard things whose character is destroyed by cutting, and whose face must be left untouched, are like the hermit crab, whose body takes the shape of the derelict shell which it has invaded, and are but the impressions of a reverse matrix.

Of a stone we can ask how has it been shaped? Its beds, its joints, its veins, its unconformities, its cleavage, its weathering, its fracture, its decay, its incrustations, its ground surfaces, its contained fossils, each and all give an answer.

Its beds may be contorted, it may have false bedding; its joints may be absent or may regulate its form; its veins may be beauties or defects, may have weakened it by over-hardness, may have grown by long infiltration, or been injected with sudden force; its cleavage may be the basis of its perfection as a building material; its weathering may be the cause of its picturesque interest, as it is the window through which we look at much of its history; its fracture may tell us of its mineralogical construction, may show best its strength and its weakness, as decay is the undoing of the original work of nature; its incrustations are a cross reference to its chemical constituents; its ground surface may show the very pencillings of force, the log-book of its journey; and its contained fossils give us the autobiography of its acquaintance.

And in a building, the like questions may be put and answered. We learn the thoughts of the designer by the use he makes of horizontal lines, of vertical lines, of diagonal lines; we learn how these may be seen, either of them alone; or how, in a further development of art, the combination of vertical and horizontal forces in different degrees become, both for the mind and for the designer's pencil, assymptotes to a curve expressed by arch, by moulding or by conventional ornament, and we may be sure that these resultant shapes alone are of real value for art expression. The proportions of the stones of a building, the varied style of its additions, the greater or less care with which such additions were carried out, the greater or less expense incurred in the treatment, the changing purpose or idea which has been transmitted, these in a building are its beds, its joints and its unconformities.

The decay and incrustation on an ancient building tell first of the selection of its materials, and little indeed of nature in the latter is to be found, but much of mischief and self-interest, where the human personal objects have resulted in the obliteration of the handiwork which preceded their time.

And when we speak of the clay in which this and other boulders have been imbedded, does not the mind recur to the coating of whitewash, which we remember to have covered all our ancient interiors and preserved them? and, are we not reminded of that cold time in art and religion which cared for none of their hidden beauties? The clay formed the substructure of our fields, the white decency of our churches even gave a show of respect

to their purposes which has characterized the nation; but after the covering up came the washing away of the bed of clay, and accounts of times gone-by are given by the boulders beneath. After the centuries of carelessness for all appearances came the time of uncovering, and the scattered remnants of our ecclesiastical decoration are now found to have a value and to give a history, nay, to underlie the plainest and least ornamental of our buildings, as religious truths must underlie our daily life.

The truths which our forefathers represented so far correspond with the boulders, that whatever is sufficiently enduring and will stand wear and tear, if a boulder, will go along its course by the seashore; if a fundamental truth either of art or of religion, it will go along its course in history; and both in one case and in the other, we need not wonder if there is only found, here and there, one who will perceive history in its shape.

Will it be maintained, then, that the outline of a stone only gives results, while the outline of a building gives indication of a purpose? Then I must refer you to the form of every shell that may be found imbedded in our rocks as adapted for the continuation of the race. I would refer to the consecutive order of the vertebræ as a continuous lesson on the laws of force and motion. Either of these instances conveys the impression of perspective to the mind. The series of outlines, all to scale, parallel to the hinge-joint of a bivalve mollusc, the continuous lines which radiate from the hinge, every one is the development of the meaning of the form, the same in infancy and through continuous adolescence, like as the delicate mouldings of a mullion curving round the tracery are presented to the eye in every continuous variety of light and shade. Let anyone study for a while the serried outline of a shell, every change of form and size in its life's history marked in the clearest manner, and he will learn a lesson on the adaptability of curves and forms which will bring him back to the design of mouldings with a sense of fitness, and of meaning in the design of all outward objects, which should help him on his way.

Should he compare the devolution in form of allied genera according to the climate and surroundings of their life, he will come back to the use of his timber, brick, sandstone, limestone, marble, iron or granite, with the feeling that he has food set before him which it is his business to use; ninety-five per cent. of which, under our present professional arrangements, he ought to convert into an enduring shell, and for the remaining five per cent. of course he gives a professional account.

Should an architect study the forms of chambered shells which culminate in the modern *nautilus*, should he note the mode in which they grew straight, or curved, or in open coil, or in close coil, or in involved coil, the outward form corresponding with the position of the internal air channel, the early years' growth of the individual still seen in the eye of the perfect full-grown volute, the mode shown in which the internal coil bursts into the wide outer rim, the cell last being formed appearing as the natural termination of the preceding convolutions, he will come back to the design of any curved architectural form with his eye refreshed with the sight of outlines that have a meaning,

and he dare not draw, for the purpose of execution in stone, in wood or in plaster, an unmeaning shape.

Let him contrast the elements of form to be seen in the bivalve shell, and its hinge forming a centre for continuous operations, with the elements of form seen in the univalve, or with the multicellular shell which always moves forward in the completion of its shape to a more complex whole, and he will recognize, in these natural forms, distinctions of principle as great as can be found in classic architecture the most trabeated, or in gothic architecture the most arcuated.

Nature's mode of working is not like the plasterer's zinc mould, horsed upon a straight edge. The mould which shaped the shells was the soft shape of the living animal in its perfect state, repeated and repeated with more and more significance, a series of different sections, but all fitting upon the mould.

From such studies the architectural sense will come back to the examination of an ancient building, and it will study the purpose of the designer, which will be found in the privacy of the residence, in the security of the castle or the worship of the church; and there will be seen the evidences of the permanent political condition of the country in them all, the lives of the dwellers be they clean or foul, the modes of offence and defence of the day, the extent of the devotion of the people. All these, in their succession and variations, convey the idea of and are part of the purpose of the artificer—as the history of the country is more to us than dates and names, and as the changing outline from the *orthoceras* to the *nautilus* conveys to the mind ideas far greater than those of mere geologic change. To an architect the study of these subjects conveys the growth of motive and the history of form, incidents in the greater ends which are in view, which make the architect a tool, an engraver of his race's annals, and make the multicellular mollusc a being whose advance in its order ceases to be a question of mere time, but becomes one of perfection, the outcome of suitability.

I have not asked you to spend an hour listening to scientific terms, the names of materials, of strata, of organisms; in our business the materials we use, and the way we use them are the facts which will represent our national character, and not the names of the styles or orders which will be forgotten, or may not be recognized. The course of our architectural style will follow history of politics and of race, and our architectonic forms will tell of the religion which has influence over our lives, and the lives of our clients. If the progress of our buildings is forward or retrogade, if the movement of our type is advancing or receding, it will indeed tell of what the education of the time is.

While stones are shaped mostly by those forces which it is the object of architects to resist, the study of the history of a stone may help them not only in the criticism of old buildings, but of their own works, may help them to find out where true architecture lies, and so aid in the formation of a real style.

Natural sciences, I would submit, and especially Geology, should be studied for the true working of materials, and ought to supplement, for our purposes, the study of all language. Geology is a science of technics, full of the knowledge of, and of the repre-

sentation of, cause and effect: of how things are done. It is phonetic to those who will read it. Architecture is a technic art, imitative of the work of nature, phonetic if its art be true.

All these, Architecture, Geology, and the Languages of mankind, are to be valued, each of them according as it delineates thought or evinces purpose, or exhibits the exercise of the mind. They are all modes of utterance, which, to the Archæologists, reflect the present and the past, and the prince[64] of those who can thus read them we this day delight to honour amongst us. They also reflect the present and the future to the Architect whose works are to tell their truest story to later ages.

THOS. M. RICKMAN.

[A Scrutiny, after the manner suggested above, of St. James's Hall, Piccadilly; by Professor T. Roger Smith, *Member of Council.*]

I found myself recently in St. James's Hall, with half an hour to wait; and the series of questions which Mr. Rickman suggests that we may put to a building when we wish to examine it being fresh in my recollection, it seemed worth while to attempt a scrutiny, in such an approximate way as the circumstances permitted. Without aspiring to carry it far, one might see whether it helped one to form a true estimate of this well-known building, and of its architect.

If we begin by asking "What story does its form tell ?" we are met at the outset by the fact that this Hall is, architecturally speaking, an interior only. It is extremely rare to find a church that is not completely visible, standing detached and unsheltered; and almost as rare to find a theatre or a hall that is not erected behind other buildings, with nothing beyond a very modest entrance to mark its position. Is this a survival of the custom of placing every church within a churchyard, and perhaps too of the custom of hiding places of public entertainment, as if they were rather too disreputable to see the light of day ?

When we are once in the Hall we may again ask, "How far is it fitted to its purpose, "and does it retain its original purpose ?" And here there can be no uncertainty. Crowded audiences, sometimes twice a day, throng this Hall—and its popularity shows that it has thoroughly answered the purpose of a music room, for which it was planned. In every part of it delicate music can be heard with the utmost distinctness, and yet the form of the building is so far unusual, that it must have required all the self-reliance in which its architect was happily not deficient, to enable him to convince the promoters of the undertaking that it would thoroughly carry out their desires.

Now that it exists, and is successful, this room must be studied as an accomplished fact, and it is perhaps possible to satisfy oneself of some of the reasons of its acoustic

[64] At the same Meeting, previous to the reading of this Paper, Dr. Schliemann had received, from the hands of the President, the Royal Gold Medal presented by Her Majesty the Queen.

qualities. As seen on paper beforehand, the design must surely have excited the misgivings of those to whom the Hanover Square Rooms represented the *ne plus ultra* of a concert hall.

St. James's Hall is in plan a rectangle, with deep recesses at the ends. The ceiling of the rectangular part is semicircular in section; and here probably the designer expected to obtain, and has actually gained, that degree of resonance without which no music room is successful. The precautions against echo are good. There is hardly any interruption to sight or sound by columns or other obstacles, and the distance to the most remote part is not extreme.

We may next perhaps ask, Are its parts "made as if the makers knew how?" And for answer we find an iron semicircular roof of great span, with no ties, carried on walls of only moderate strength, and executed at a time when iron roofs were less common than they since have become. We notice the successful employment of iron, both wrought and cast, in carrying the balconies; but above all, we remark an employment of plaster on an entirely new method, which was worked out by Owen Jones and Monsieur Desachy first for this building, and which enabled all the rich ornament of the ceiling to be moulded in pieces that were at once light and stiff, and that could be fixed in place with perfect ease. The happy treatment of the cast-iron grilles that form the front of the balconies, and the extensive perforation of every part of the ceiling for ventilation, are among the incidental features which show that the builders knew what they were about.

Again we ask, "Is the style native, or is the art, though beautiful in itself, out of "place?" And here a very interesting result comes out. The ceiling of St. James's Hall is the work of a very great and very true artist. It is in a style essentially his own. And the interior of this building is, in my opinion, not equalled, for quiet grace, for the subtle use of oblique lines, and for successful surface ornament, by anything that I know in or out of London. The art, however, is founded upon Saracenic art, though it is not a direct copy of Saracenic forms or treatment; and it is worth remark that it has remained substantially unproductive. Any building half as novel and half as good, if its style had been Gothic, or if its style had been Renaissance, would have had a large following. St. James's Hall has not been the first of a series, and has practically remained without effect on modern English art. Is not this circumstance really due to that innate antipathy between the Christian and the Mussulman, which we all feel without acknowledging it? And has not the comparative failure of Owen Jones's gallant attempt to naturalize Saracenic architecture in Great Britain borne indirect testimony to the fact, that antipathies and sympathies of race, religion and culture are infinitely powerful factors in the architectural history of the world, and present themselves at points where their action could hardly have been anticipated?

The boulder at Criccieth has fallen on evil days at last, and has been split by the hand of man. In two particulars Owen Jones's masterpiece has been as ill-treated, as almost every great building is sure to be, by its guardians. An ungainly organ has been introduced at the back, and its vast mass appears to be balanced on a single iron column

no thicker than a good stout gas-pipe. This blemish might, with a very little architectural sagacity, be corrected; at present it seriously detracts from the beauty of the *ensemble.* The other calamity which has befallen the Hall is the loss of the original and most picturesque method of lighting designed for it by its architect, who introduced a series of stars of light, pendant from the ribs, and so when alight marking out the lines of the building. For these fairy-like lights glaring sun-burners have been substituted, to the great damage of the architectural effect. Now, however, that the electric light is available, and is freely used in this very way, is it too much to hope that Owen Jones's illumination of the interior may once more reappear, with that added beauty which the greater brilliancy of the new light can bestow?

It seems to the writer of these few lines that, even without pursuing the inquiry further, the questions which were put to this building, and the replies which could be obtained, suffice to establish that this Hall is a real work of skill and of art; and that its architect, even had he done nothing else, would be entitled to claim, in respect of this one work alone, that consideration which is due to a sagacious planner, a safe yet bold constructor, and an accomplished yet original artist.

T. ROGER SMITH.

T.R.Del

189, THE BOULDER SEEN FROM UNDER THE CLIFF.

T R Del.

190, THE SHORE AT CRICCIETH LOOKING WEST.

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191, THE BOULDER SEEN FROM THE WATER'S EDGE.

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INK-PHOTO. SPRAGUE & Co LONDON

192, NEAR VIEW OF THE BOULDER.

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*An asterisk * following an item denotes that there is an illustration connected with it.*

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Dryden Press: J. Davy & Sons, 137, Long Acre, London.